Rock Products

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Chicago, June 12, 1926 (*Issued Every Other Week*) Volume XXIX, No. 12

"PENNSYLVANIA"

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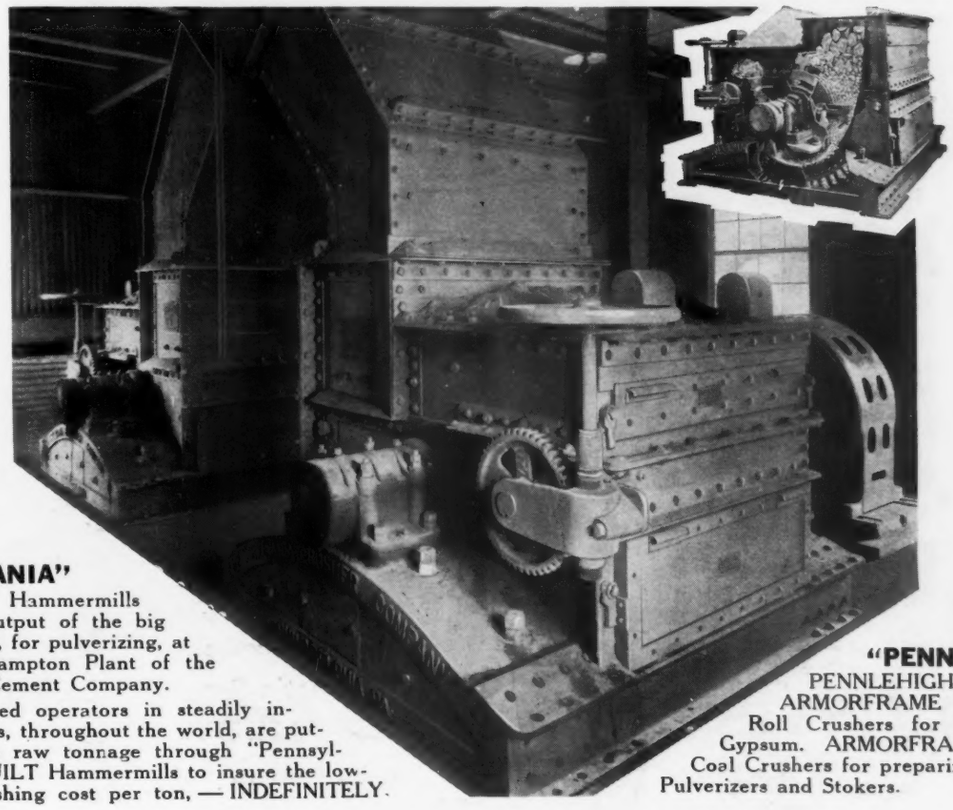

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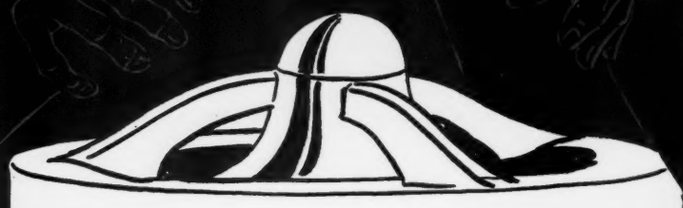

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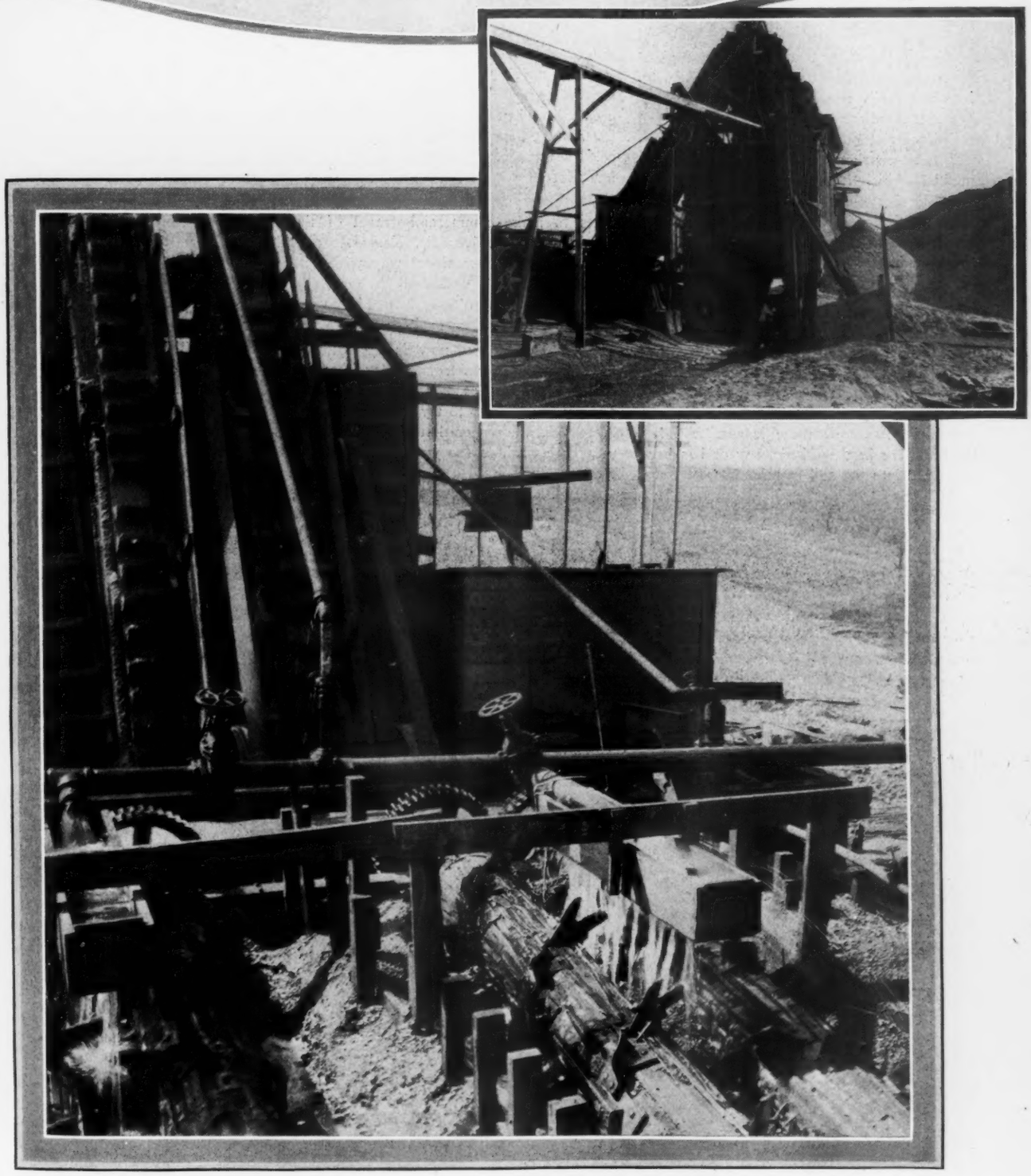


Log washers and heavy sprays at the plant of the Peerless Flint Gravel Co., Wichita, Kansas, wash a very unpromising material to a clean and salable product

Solving a Hard Problem in Washing Sand and Gravel

Peerless Flint Gravel Co. of Wichita, Kansas, Uses Log Washers Effectively on a Very Clayey Bank Material

THE plant of the Peerless Flint Gravel Co. of Witchita, Kansas, is of a type of which many more will be built as our deposits of easily washed material become exhausted. Ordinary methods of washing had failed completely in bringing its bank material to a marketable condition before the methods which it uses were adopted. And yet there is nothing particularly novel about these methods in themselves; the novelty consists in their application to the sand and gravel industry.

The Kansas Flint Hills

The company has about 800 acres of land of which 500 are gravel bearing. The deposit lies at the lower end of the ridge which is known as the Kansas flint hills. These hills overlie limestone ledges and the flints are presumably from the disintegration of the upper strata of these ledges. All but the flints has been washed away or has been converted into the soil mantle.

The flints are found in the stickiest and gummiest red clay that the writer has seen in any gravel field. There is some white clay with it too, the sort that makes hard clay balls when it passes through the washing plant. The combination makes as difficult a washing proposition as can be imagained.

The first plant to attempt to wash these flints to make commercial gravel of them was erected at Silverdale, Kansas. It was put up in the conventional way with cylindrical scrubbers followed by revolving screens. It failed utterly in making a clean enough product to be sold.

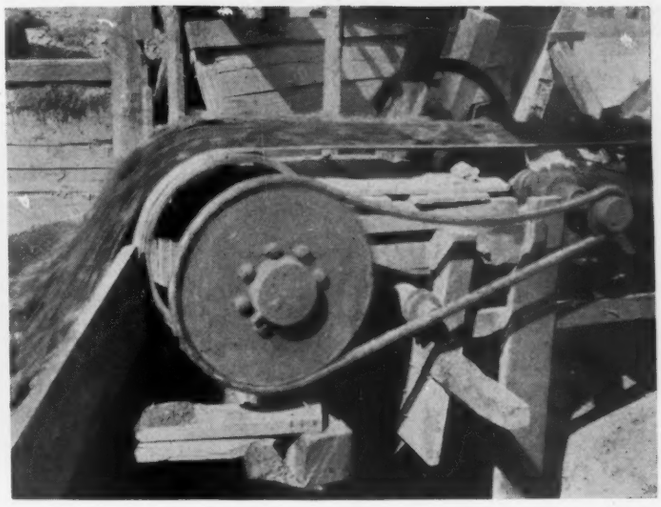
Watt Sleeth, who now is superintendent of the Peerless plant, was acquainted with some of the owners of the Silverdale plant and persuaded them to try log washers. Mr. Sleeth told the writer that he got the idea of using log washers for washing gravel from reading Rock Products. Then he saw the machines used for washing iron ore in Tennessee and he thought they ought to be as good for gravel as for iron ore. So he made a double log washer 14 ft. long, using "eight square" timbers for the log. Although he could not get a heavy tonnage through this small machine he got a very clean product and satisfied himself that the method was applicable to washing gravel on a commercial scale. It was found that from 60% to 80% of the material from the bank could be recovered as a clean and merchantable product.

Experimenting with Log Washers

When the Peerless company's plant was to be built the experience gained from the operation of the small log washers at the Silverdale plant was the basis of its design. The log washers were built at the plant along the lines that had been proven successful. As the use of these machines is not so common in the sand and gravel in-

The deposit is flat so the workings must cover considerable area. The gas-shovel loads into trucks that haul the material to the conveyor hopper. The same shovel strips and side casts the black top soil

Junction of the two belts of the 1000-ft. field conveyor



The discharge of the field conveyor entering the log washers

dustry it may be well to describe this particular installation in detail.

The logs of the machine are made of Louisiana pine which was bought in four 18-in. squared timbers. These were cut down to an octagonal section at the plant. The blades were made at a local foundry of hard chilled iron. Originally these blades were fastened directly to the logs by bolts, but when the blades were worn out and had to be changed the taking out and and replacing of these bolts was hard on the logs, so a socket was devised to hold the blades. This was bolted by four ⅞-in. bolts to the logs and the paddles were bolted to the sockets by three bolts. At intervals between the blades round pointed spikes were screwed into the logs to aid in breaking up the lumps of clay. These wooden logs last five years.

Wooden Logs Preferred to Steel

Mr. Sleeth says that he prefers the wooden log to the log built up of steel bars such as is used in the phosphate rock and iron ore fields. He thinks it less liable to break under a heavy load or when the paddles are caught.

The gudgeons are of ample size and the bearings are protected by packing rings so that water carrying mud and sand cannot enter. Each log has a large gear at the upper end and this meshes with a pinion which also engages with the gear of the next log. This drives the logs in opposite directions. The blades are placed on the logs so that they form a sort of broken screw thread, and as the logs revolve in opposite directions one screw thread is made right hand and the other left hand.

The logs are inclined about 1-in. to the foot. It was found that this inclination had about as much as anything to do with the work of the logs, not only in the cleanliness of the product but in the power required to drive them. The flatter the logs are placed the heavier the load of gravel in which they are working and the more power that is required. With the 1-in. to the foot inclination, the power required for each pair of logs (driven from a common pinion) is 25 h.p. or 50 h.p. for the whole installation. Water is admitted with the feed at the lower end of the logs and supplied from the spray boxes shown at the upper end of the logs in the frontispiece. About 1200 g.p.m. are used in the plant and almost all of it is put in to the log washer.

Looking along the conveyor to the shovel

The remainder of the plant is very simple. The discharge from each pair of logs goes to a 12-in. bucket and belt elevator. The elevator discharge goes over a gravity screen which takes out the greater part of the sand and then into a revolving screen. These screens were made by the Webb City Foundry and Machine Co. and they are 12-ft. long and the main section is 30-in. in diameter. There is a jacket of 40-in. diameter, 6 ft. long for a sand screen. These screens have 1-in., 2-in. and 2½-in. perforations and the jacket has ⅜-in. perforations.

About 10% of the material is oversize, although none of it exceeds 6-in. in diameter. At present this is being stored but a crusher is soon to be installed.

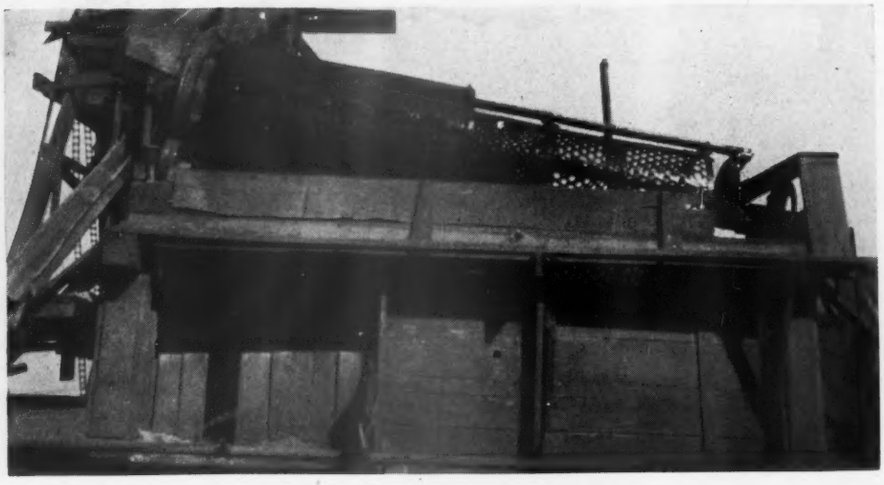
The sand from the gravity screens and from the revolving screens is run off to stock piles. Very little water comes from the log washers and a small amount is all that is needed for the washing sprays in the screens. Hence, the amount of water that accompanies the sand to the stock piles is so small that it drains readily through the clean sand.

No attempt is made to recover the fine sand that escapes with the mud in the overflow of the log washers but this is because there is no demand for it at present. If a demand for fine plastering sand could be found the sand might be recovered from the log washer overflow by the ordinary sand settling devices.

It will be seen that the plant is really a two-unit plant, each unit consisting of a pair of log washers, an elevator, a gravity screen and a revolving screen.

Working the Bank

The method of working the deposit and bringing the bank material to the plant is almost as unusual as the washing method. The ground is dug with a Thew gas shovel which loads into Ford trucks. These take the material to a hopper which is at the end of a conveyor belt that leads to the plant. The conveyor belt is in two sections, of 400 and 600 ft. each. It was originally intended to have one section movable and to swing it around so as to cover a circular area, but hauling the material by trucks to the conveyor hopper has been found cheaper. The



One of the two screens above the bins

conveying of material from the hopper to the plant, however, has been found considerably cheaper than bringing it in by truck so the present combination system is the cheapest that could be worked out for the conditions. The conveyor has another advantage, that of providing a fairly steady feed of material to the log washers. This is essential as these machines cannot be heavily overloaded without consuming a great deal of power and doing poor work.

The product of the plant has to be carried about a half mile to the nearest railway loading point. It is transported by trains of 36-in. gage, Lakewood, side-dump cars drawn by a Burton locomotive. The greater part of the plant's production is shipped to Wichita.

The ordinary output of the plant is 750 tons per day, of which 150 tons is sand. This has been increased at times. The capacity of the log washers varies with the proportion of gravel, but the figure given above represents a fair average.

If the system of washing were to be applied to deposits with a large amount of oversize, or even if there were occasional large pieces, a primary screen and crusher would have to be installed to keep oversize out of the log washer. About 4-in. is the limit in diameter for pieces that should go to the log washer.

The office of the Peerless Flint Gravel Co. is in the W. K. H. building, Wichita. C. A. Meilert is president and general manager of the company, Charles A. Watson is vice-president and H. G. Meilert, secretary-treasurer.

Possible Uses of California Black Sand

THERE are extensive stretches along the coast of California where the heavier constituents of the beach sands have been concentrated by wave action into deposits of so-called "black sand," says a recent bulletin of the California State Mining Bureau. The composition of this heavy concentrate varies somewhat with the locality. In general, the following commercial minerals are present in greater or less amount: magnetite, gold, ilmenite (oxide of iron and titanium), garnet, zircon, hematite, chromite, and the platinum group metals. Could each of these minerals be readily and completely separated from the others and from the olivine, quartz, and other worthless constituents, they would be readily marketable. Gold and platinum are found in relatively minute amounts only, but on account of their high value, practically all past efforts to work these sands have been confined to the recovery of these metals.

Besides the uncertain profitable production of gold and platinum from this source, the use of black sand in the manufacture of artificial iron castings, where great strength is not required, has been suggested. Some experimental work has been carried on to determine the practicability of the use of these sands for this purpose, including the making of sash weights by molding or briquetting the material into the desired form with oxy-chloride (magnesite) cement, portland cement or other binder. Black sand may also be utilized in concrete mixes, where a concentrated weight is wanted, as in concrete balance-weights used on bascule-type bridges and similar structures.

By subjecting the magnetite in black sand to an oxidizing roast, it may be changed to the ferric state, producing a red oxide (Fe_2O_3), which forms, when finely ground, a mineral pigment suitable for the manufacture of paint. The pigment so made is said to be superior to ground hematite or the natural soft red oxide. Magnetite in black sand is also used as an ore of iron to some extent. This magnetite usually contains from 5 to 10% titanium.—*Engineering and Mining Journal-Press.*

Silica Investigation

PROBABLY no other mineral has more diversified uses, or is of more value in industry and the arts, than silica in its various forms. It is the most abundant mineral compound in the world, and every state in this country produces important quantities. The Bureau of Mines has completed a study of this exceedingly useful mineral in all its phases.

The train which takes the washed material to the car-loading bins

Looking down on the car-loading bins from the track above

Hydraulic operations in taking out Florida phosphate. The overburden is about twice the depth of the phosphate ground, although the picture does not show it because of the distance

Conditions in Florida Phosphate Field

Production Has Increased to Almost That of the Boom Year but Price Is Still Too Low

By Edmund Shaw
Editor, Rock Products

A REPRESENTATIVE of one of the largest phosphate rock producers told the writer recently that in February one of their Florida plants had passed all records for production. He thought that other plants in Florida might say the same. Reports from Tennessee are to the effect that all the important plants are working steadily. There are recent advices of a large increase in European importations from the United States. It is unfortunate that the price is still too low to afford an adequate profit to the producer, but in the face of a strengthening demand this is expected to be remedied before long.

The figures of Florida production, which is between 80% and 90% of the total production of the United States, show the steady increase that has followed the boom and slump of 1920 and 1921. These are:

1919 (year of strike)	1,144,000 tons
1920 (boom year)	2,977,000 tons
1921 (general depression)	1,644,000 tons
1922	1,975,000 tons
1923	2,353,000 tons
1924	2,267,000 tons
1925 (estimated)	2,730,000 tons

The figures up to and including 1924 are from Bureau of Mines reports; the production of 1925 has been estimated by one who is thoroughly familiar with the industry and who has the necessary information from which to make an estimate.

It is generally admitted that the hardest blow the phosphate rock industry has received was the boom which followed the strike of 1919 in Florida. Stocks were very low, the civilized nations of the world were all calling for phosphate and the price went up to almost twice what it had been. Prices for everything were abnormally high that year and wages were rising in proportion. Plants were built that were closed down in the next year or two because the market could not absorb their product. High cost production methods were used because the cost of production was less important than getting the phosphate to supply the big market. When the slump in prices came the momentum of production was so great that it could not be stopped at once and large stocks were accumulated which tended to depress an already sagging price. The recovery from such a condition to the healthy growth of the present day is an excellent proof of the stability that really underlies the industry.

The export business is said to be not the factor that it formerly was (it was 35% to 40% in 1909), but it is an important part of the demand. The production of Morocco

and other distant lands has by no means forced American phosphate from the European market. In the face of such competition American export of phosphate is said to be steadily rising. But the great market increase comes from the strong American demand.

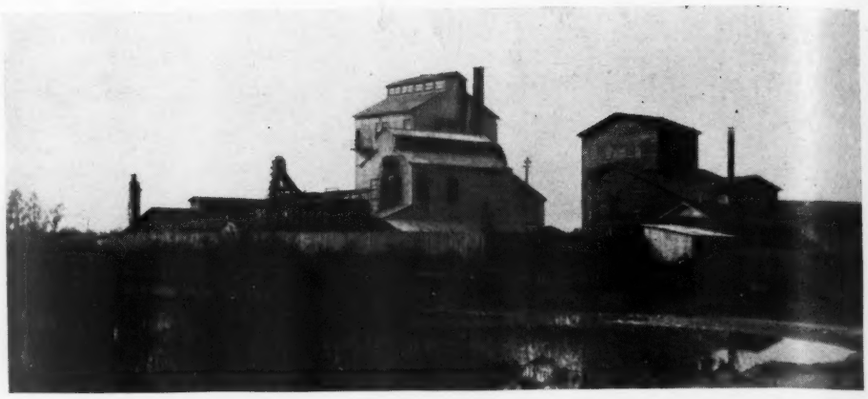
The low price of phosphate during the lean years has had one excellent result. It forced companies to study production methods with a view to lowering costs to the last notch. And their success in doing this is one of the wonders of the rock products industries.

In February the writer visited one of the largest producing plants in Florida and saw the pit operations. At the particular point which was being worked 24 ft. of overburden was being stripped to uncover 12 ft. of phosphate rock in its matrix. Not all of this 12 ft. was marketable, the recovery in Florida varying from 15% to 30% of the material sent to the dryer. It was roughly figured that 15 tons of dirt were being removed for one ton of phosphate rock that was marketed. The present cost of phosphate rock of 72% B.P.L. content is $4.25 per ton. If, say, 50 cents is subtracted as the cost of drying and the extra handling phosphate rock must receive, we have a fair basis by which to compare it with the sand and gravel industry, which is the most like it. Dividing the remainder by 15 we have 25 cents per ton taken from the bank. Not many sand and gravel producers would care to engage in the business at so low a return per ton excavated. And phosphate rock operations are figured as the long ton, which would reduce the figures for recovery by 10%.

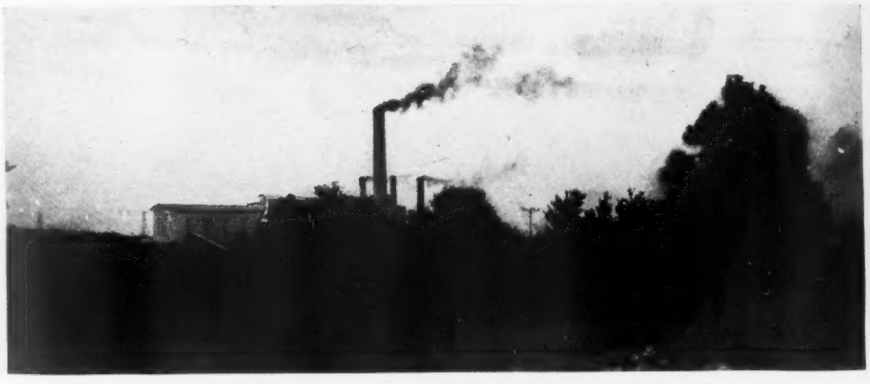
Such low production costs can only be obtained by very large organizations with heavy investments in buildings and equipment. When this is considered the conclusion is inescapable that the return is as yet not adequate to pay interest and a proper depletion and depreciation charge in the phosphate rock industry. The price is still far too low and "the industry is still living by eating up its capital," as one producer put it. But it is hoped that the stronger market will show a betterment of prices, and the principal user of phosphate rock, the farmer, would never feel it. The cost of acid phosphate delivered to the farmer is made up so much of the cost of acid, labor and freight and so little of the cost of the raw rock that a substantial increase in the price of phosphate rock, say, $1 per ton, would add only a small percentage to it.

Hydraulic methods of stripping and mining are still much used in the Florida fields, although the tendency is to use dragline excavators, especially for stripping. It is generally conceded that the dragline can strip more cheaply, but companies which have heavy investments in hydraulicking machinery feel that the difference in cost might not warrent the expense and difficulties of making the change.

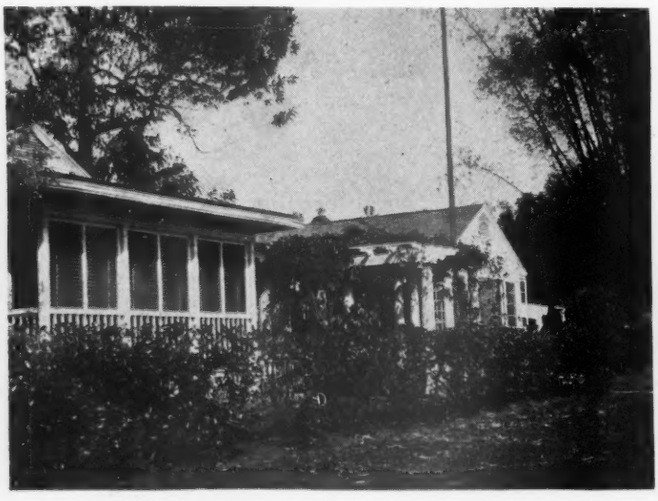
Some of the companies have installed draglines, however. The International Agricultural Corp. as this is written is just installing a Marion 300, which will handle a 6-yd. bucket at the end of its 165-ft. boom. This is said to be the largest machine in the field.



One of the plants of American Cyanamid Co.



Plant of American Agricultural Chemical Corp. near Pearce, Fla.



Residence of manager of American Cyanamid Co. at Brewster, Fla.

Another of the American Cyanamid Co.'s plants at Brewster, Fla.

Stock piles of high-grade phosphate rock near Mulberry, Fla.

EXPORTS OF PHOSPHATE ROCK FROM THE UNITED STATES

	High-Grade Hard Rock		Land Pebbles	
Year	Tons	Value	Tons	Value
1914*	475,000	$4,753,000	1,001,000	$5,858,000
1920	345,000	4,496,000	693,000	5,594,000
1921	183,000	2,593,000	544,000	4,628,000
1922	202,000	2,549,000	513,000	3,269,000
1923	194,000	2,478,000	631,000	3,273,000
1924	151,000	1,814,000	656,000	3,210,000
1925	159,000	2,283,000	698,000	3,287,000

*Fiscal year.

(Table from *Industrial and Engineering Chemistry.*)

It is against the best interests of the public that the price of phosphate rock should remain so low as not to make an adequate return on the capital invested. Phosphate rock resources were thought at one time to be inexhaustible, but now they are known to have very definite limits. The Florida State Geological Survey has estimated the state's present reserves to be 249,000,000 tons, which is about five times the 49,000,000 tons already taken out. If only the rock which analyzes 74% B.P.L. is considered, the reserves are considerably less. Tennessee will never have a much larger production than it has at present and the deposits of Idaho and other western states are rather far from market. Intelligent use of our phosphate reserves would be to take out what is needed in a systematic and cleanly manner with as little waste as there can be, a procedure that is only possible when the product is marketed at a price that will give a fair return on the investment needed.

Export business in phosphate rock and pebble phosphate is making a gradual recovery, though it has not as yet returned either to the tonnage or the value of the years before the war. The export figures for 1914 as given in the accompanying table are typical of the five-year prewar period.

Germany buys the larger part of the hard rock, and other countries of western Europe absorb the rest of this export. Europe also takes the major portion of the pebble phosphate, though trade is being established with Cuba, Canada, Japan, British South Africa and other countries.

Celite—an Admixture for Concrete

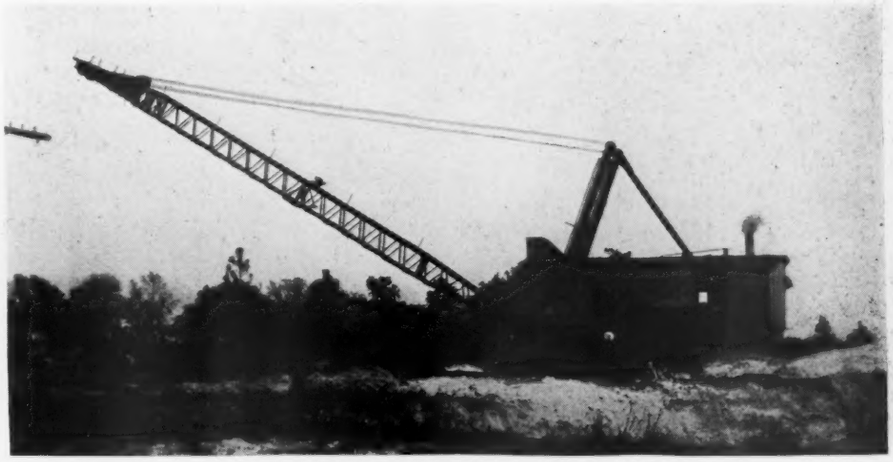
THE Celite Products Co., Los Angeles, Calif., has recently issued bulletin No. 314 on the uses and advantages of Celite in concrete construction.

Celite is a practically pure amorphous silica (SiO_2) and comes on the market as a lightweight powder in an extremely finely divided state. In using for concrete work, it is added along with the other dry materials making up the batch. The amount to be added is determined by the nature of the aggregate used; the harsher the aggregate the greater proportion of Celite to be used. Of the total, the amount of Celite added constitutes a very small proportion. By the use of Celite in all classes of concrete work, better concrete is said to result because of improved workability, increased water tightness, etc. Several papers recently presented at meetings of the American Society for Testing Materials bear out many of the advantages claimed by the makers of Celite.

The bulletin states:

"The advantages derived through the use of this material as an admixture in concrete, namely, improved workability and greater uniformity, strength and watertightness, are of great importance in all classes of concrete construction. Furthermore, these advantages can be secured with little or no extra cost as the increased yield of finished concrete in place is in practically all cases sufficient to offset the cost of the Celite used.

"Celite is a permanent element in concrete and does not affect the time of setting. It accomplishes the desired purposes in a practical manner because of its light weight, extreme fineness and its ability to promote workability and its attendant advantages through simple physical means."



Dragline stripping new ground near Lakeland, Fla.

Shrinkage Stope Method of Production from Limestone Mines

With Particular Reference to Operations of El Dorado Lime and Minerals Company, Shingle Springs, Calif.

By J. R. Thoenen
Mining Engineer, Greenville, Ohio

LIMESTONE occurs in great abundance in the United States in flat or slightly inclined strata and is recovered in the majority of cases by open quarry methods. Of recent years underground mining has come into prominence, but has been confined principally to the flat deposits. There are two reasons for this: First, the limestone producers were familiar with flat deposits, had worked them for years, and owned extensive property containing limestone which, owing to increasing depth of overburden, could not be quarried at a profit. This led to the development of tunnel mines from the sides of open pits and as a growing number of quarries encountered increased overburden costs the number of tunnel mines increased. Second, few quarry operators have any knowledge of mining methods other than that gained by their own experiences in flat stone. Neither practical nor technical miners have been wont to pay particular attention to the extraction of non-metallic minerals with the exception of coal. With this lack of data on underground mining methods the quarry operator naturally looked with skepticism on any suggestion that steeply pitching or vertical strata could be mined at a profit through expensive shafts and underground development.

Fig. 1—Old pit, showing outcrop of limestone formation

In the eastern part of the United States geologic disturbances have upturned the various formations to all sorts of angles. Many of these steeply pitching ledges have been worked by open pit methods and abandoned when the stone on the surface has been depleted.

In the western states limestone is far less prevalent and the rocks are more often of igneous origin. Greater disturbances have occurred and as a consequence where limestone is found it is more often in contorted strata or large masses inclosed in eruptive rocks.

The operation of the American Lime & Stone Co. at Bellefonte, Penn., illustrates a typical example of mining limestone from beds which have been tilted by geologic disturbances and is the only example of this class of mining known to the writer as applied to limestone in the eastern states, although there are many such deposits susceptible to this method untouched or only partially worked by surface pits.

The common method of working steeply pitching seams is what is known as the "Shrinkage Stope" method. This method was described by the writer in the June 28, 1924, issue of Rock Products and operations at Bellefonte have been recounted by other authors in various publications. (A. B. Parsons in *Engineering and Mining Journal-Press*, p. 605, vol. 118, No. 16, and N. S. Greensfelder in *Explosives Engineer*, June, 1923, vol. 4, No. 1.)

The El Dorado Lime & Minerals Co., of Shingle Springs, Calif. (postoffice, Shingle, Calif.), was probably the first to adopt the shrinkage method for the production of limestone in this country. This operation was

originally started by two partners as an open pit for the extraction of limestone to be burned into lime. Figs. 1 and 2 show two views of this old pit now abandoned and partially filled with water. This pit was worked to a depth of approximately 90 ft. below the outcrop and broken stone hoisted and dumped into cars on surface by means of the derrick shown in Fig. 1. Progress to the south along the strike of the outcrop was halted by a transverse fault which abruptly terminated the limestone and replaced it with clay and gravel as can be seen in Fig. 2. Two stone pot type kilns were built (Fig. 4) at considerable distance from the pit, but before they were fired the partners suffered financial difficulties and the whole project was abandoned.

The limestone is massive in structure with little remaining evidence of former bedding and has a pronounced crystalline texture. Analyses vary from 97 to 99½% $CaCO_3$ with 0.25% SiO_2 and 0.5% $MgCO_3$. It outcrops in three ledges north of the present workings, two of which have been developed underground.

The present company on acquiring control thoroughly prospected the deposit with diamond drills and when assured of an extensive deposit unaffected materially by the fault which cut off the open pit, sank a three-compartment vertical shaft 7x16 ft. in section on the east wall of the center ledge of limestone and a short distance south of the open pit to a depth of 366 ft.

Levels 9 ft. high and 22 ft. wide were driven north and south at 150 and 300 ft. below the surface and in the center of the ledge which was found to average 60 ft. in thickness. Development to the west disclosed a lense or horse of slate varying in thickness from 0 to 25 ft. and beyond this 30 ft. of limestone in the second ledge. South of the shaft these two ledges come together and form a single deposit averaging 75 ft. in thickness. Two hundred feet to the east lies a third ledge on which no development has been done. The walls on each side of the two ledges now being worked are slate. Cutting diagonally through the middle or 60-ft. ledge is an aplite dike varying in thick-

Fig. 2—Abrupt termination of limestone by transverse fault

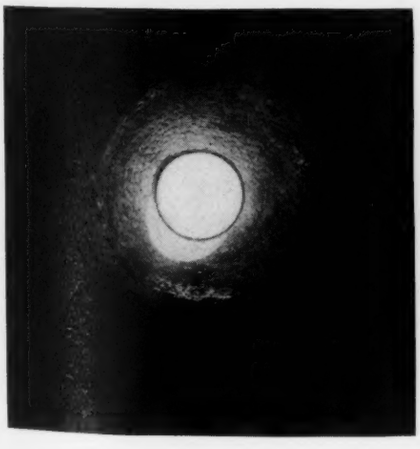


Fig. 3—Looking upward through kiln

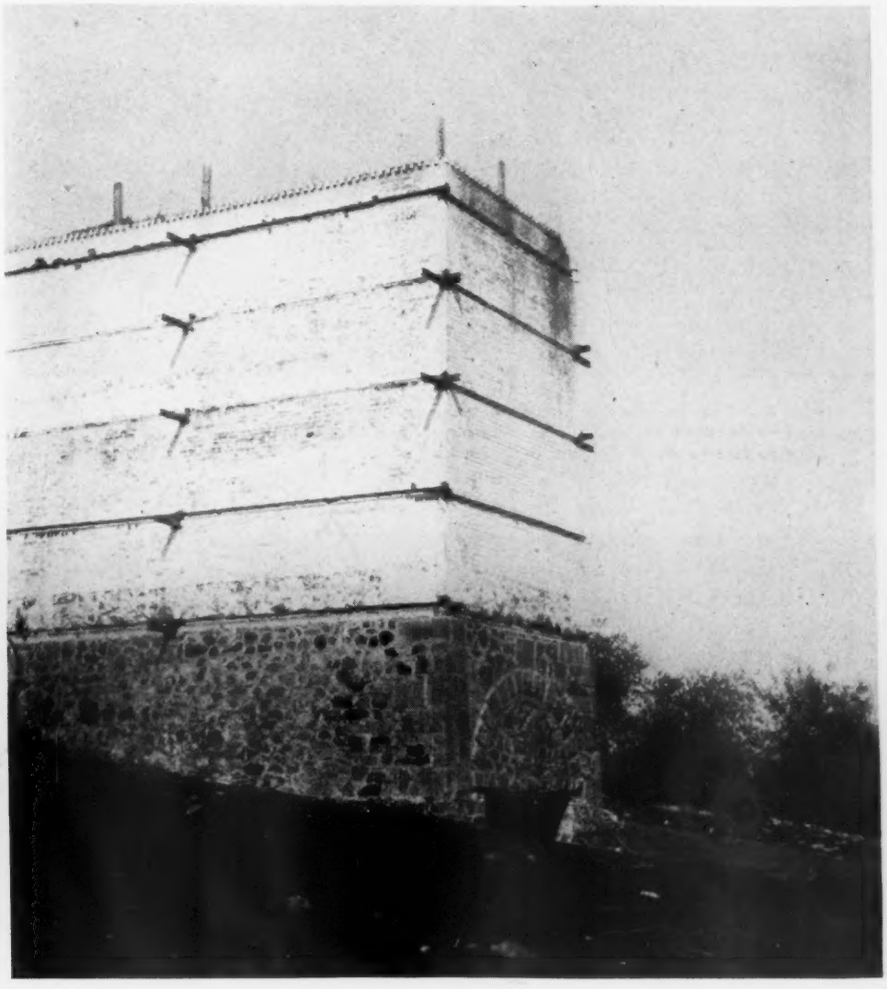


Fig. 4—Two stone kilns of pot type are still in existence

Fig. 5—Pits in middle distance are caused by surface water entering mine

Fig. 6—One of the transverse benches which is carried from wall to wall. The picture shows the relation to the roof. Note the drill starting a hole at the left of the picture

Fig. 7—Concrete dam to shut out surface water

ness and standing nearly vertical. A second igneous intrusion cuts the limestone east and west and dips south about 45 deg. This latter intrusion is quite uniformly 4 ft. thick wherever encountered in the mine and is probably in the position of the fault which stopped operations in the open quarry.

In early mining the open stope with underhand bench method was employed between the shaft and open pit, but this was soon abandoned for the shrinkage stopes now used. These old stopes have been partially filled with surface material carried in through old water courses in the limestone. After several sudden caves and consequent filling of stopes with this material the south bank of the open pit slumped showing a direct connection with the mine in this direction. These old watercourses were then filled with concrete reinforced with old rails and wire cable and no further trouble has ensued.

The first step in the mining practice after levels have been driven is to cut holes in the sides of the drifts for chutes. These are cut at 30 ft. center to center and staggered along both sides. Fifteen feet of stone is left above the level for the stope floor and chutes are funneled out in this with the wide ends upwards. These are then connected by blasting out the intervening stone and the back stope started. Manway raises are driven at convenient intervals for access to the stopes, but unlike the Bellefonte practice in that they are not carried in the pillars. As the broken stone accumulates in the stopes the manways are raised by 3x12 in. timber cribs 3 ft. 6 in. square inside and carried up as the stope roof is broken. They thus become simply cribbed passageways through the broken stone. When the stope is emptied the shrinkage is drawn and the cribs simply collapse on top of the broken material. They are cheaper to construct than the pillar raises of the Bellefonte practice but are sometimes lost through blasting in the stopes or unequal drawing of adjacent chutes. A ventilation raise is driven

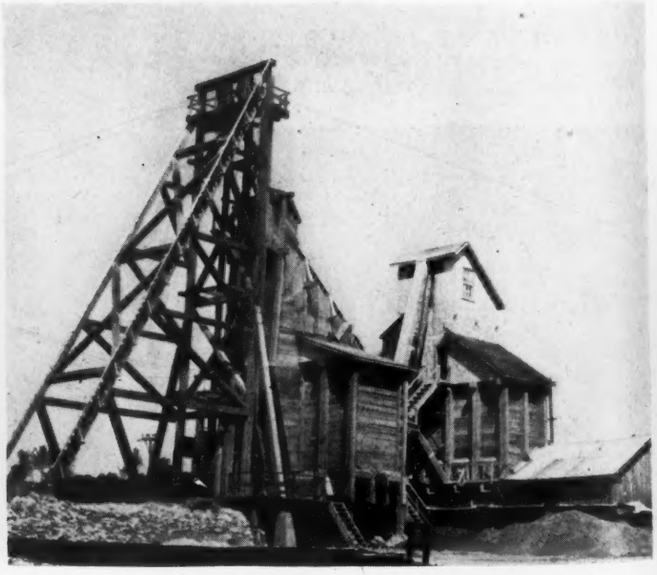


Fig. 8—Headframe over shaft

Fig. 9—Grizzly for initial separation of stone

Fig. 10—Rope driven mine hoist

from each stope to the level above which in connection with the cribbed manways provides adequate removal of obnoxious explosive gases.

Stopes are cut 260 ft. along the strike and rib pillars left 40 ft. thick. A floor pillar 50 ft. thick is left below the 150-ft. station and a 25-ft. pillar to protect the shaft. The mining operation is that of the ordinary back stope method using flat holes drilled from columns set up on the broken stone and against the roof. In this way benches are carried from wall to wall transverse of the strike and advanced longitudinally. Fig. 6 is a photograph taken of one of these benches and shows the position with relation to the back or roof. To the left will be noticed the end of a drill in the act of starting a hole in the bench. Each bench is carried 5 to 8 ft. thick. The present practice is to use 40 holes to shoot such a bench the full width of the stope. This results in excessive drilling and explosive costs but there is very little secondary blasting to be done. This procedure could not be employed where the stone was used for lime on account of the increased number of spalls produced. The finer stone makes chute operation easier and at this plant the smaller sizes find a ready market.

Fig. 11—Close-up of hoist

Chutes in the levels are built of wood, lined with steel plates and patterned after western metal mine practice. Planks, raised and lowered by hand or bar, control the flow of broken stone to the cars. The throat opening is 4x6 ft., allowing the passage of large blocks.

In driving levels side cuts are used without rib holes and the cuts alternate from side to side. Forty-four 8-ft. holes are drilled to each round.

All holes in both development work and in the stopes are drilled wet. Ingersoll-Rand drills, Types DCRW 13 and 430 are used in the stopes and I. R. No. 148 in the drifts with 1-in. hollow hexagon steel and Carr bits.

Hercules dynamite in 25% and 40% strengths and 1x8 in. size with fuse and No. 6 caps is used in drifting and 25% in stoping.

In driving levels 2-ton steel, rocker, side dump cars are loaded and trammed by hand to the shaft station. The same cars are used in loading from the chutes. At the shaft station the cars are dumped over an inclined grizzly with 10-in. openings as shown in Fig. 9. Undersize passes through to the skip loading pocket and oversize is sledged by hand. One and one-quarter ton steel Kimberly type skips are loaded through chutes at the bottom of the loading pocket and hoisted in balance to the surface, where they are auto-

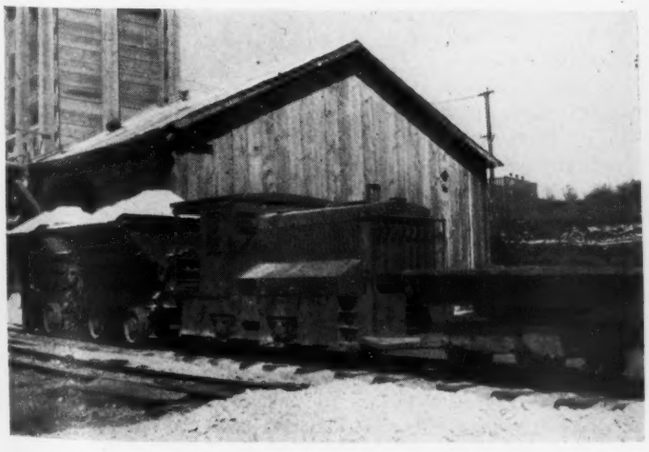


Fig. 12—Surface haulage equipment

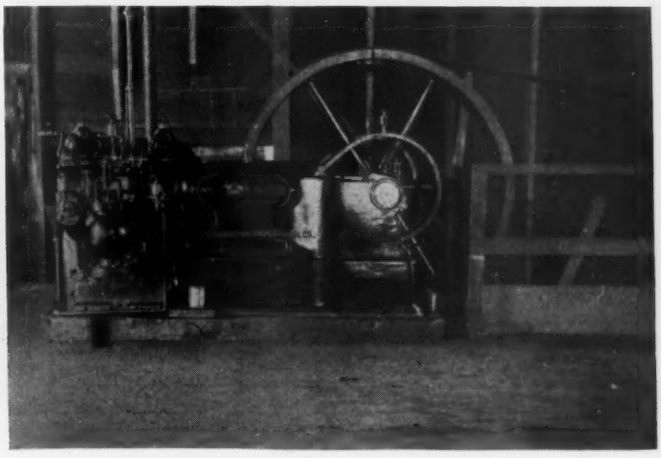


Fig. 13—Air compressor for operating drills

Fig. 14—One of the products

matically dumped over a grizzly inclined at 30 deg. The first 15 ft. of this grizzly is spaced 2½ in. and the lower 15 ft. at 6 in. The oversize goes direct to bins for furnace flux stone. Undersize from the lower grizzly goes to bins for foundry flux and that from the upper grizzly to bins for concrete stone or to a No. 4 Jeffrey swing hammer pulverizer with Blake type initial crusher, where it is reduced to ½- and ¾-in. size. A larger size pulverizer of the same type is at hand for future installation.

The crushed product is fed to a whip tap screen which makes three sizes, viz.: plus 3-mesh which is returned to the pulverizer in closed circuit; minus 3-mesh to plus 14-mesh which goes to a Hum-mer screen, and minus 14-mesh to bins for glass flux and agricultural stone.

The Hum-mer screen makes coarse, medium and fine chick grit as minus 3- to plus 6-mesh, minus 6- to plus 8-mesh, and minus 8- to plus 14-mesh. The minus 14-mesh goes into the glass flux and agricultural stone bin as from the other screen.

All stone is hauled two miles to the railway by a Plymouth 7-ton gasoline locomotive fitted with a special motor to cope with adverse grades.

Compressed air is supplied by a Chicago Pneumatic Tool Co. belt-driven compressor. The stone is hoisted through the shaft by a double drum rope-driven hoist. The following data will be of interest:

Tons broken per man in mine	7.00
Tons broken per ft. of drilling	.71
Tons broken per lb. of explosive	2.55

The commodious company boarding house for employees can be seen in one of the illustrations. The same illustration shows something of the surrounding scenery as well.

The superintendent, J. H. Bell, is a mining engineer with a long experience in metal mines, which is evidenced in the very efficient operation of the mine.

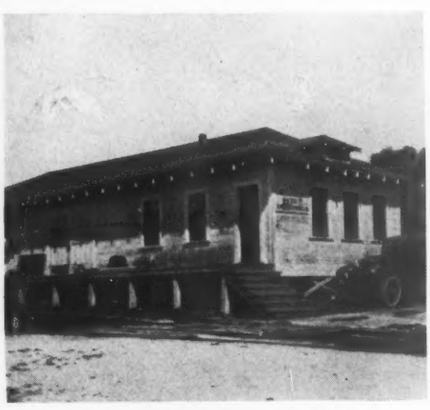


Fig. 15—Office of the company

Cyanite Makes a High-Grade Refractory

AN investigation of the properties of brick, made of cyanite, a fire-resisting material, has been partially completed by M. S. Freed, research associate for Henry A. Golwynne at the Bureau of Standards, Department of Commerce. The material was taken from a recently discovered deposit in India, and much of it contains over 95% pure cyanite. Cyanite, either raw or calcined, pure or bonded with clay, produced refractory bodies capable of withstanding standard and modified laboratory tests for high-grade refractories. The bodies showed excellent resistance to spalling and to deformation under load at high temperature. They also showed a uniform and low thermal expansion and a high melting point.

Cyanite is a near relative of stillimanite, which holds a high place among refractory minerals. Both are compounds of silica and alumina and at a high temperature cyanite is said to have the physical characteristics of stillimanite. Cyanite has been found in many places in the United States.

Effect of Cement Dust on the Lungs

RECENT work by German scientists reported in the German paper *Zement* on the effects of cement dust on workers long subjected to these dusts tend to disprove the common belief that they promote tuberculosis and are extremely dangerous to the welware and health of the workers. It has been found that even exposure to these dusts for periods of 10 years or longer did not lead to any permanent effects on the lungs.

At the utmost there resulted catarrhal disorders with a tendency to enlargement of the lungs and dust impregnation of the lungs as shown by X-ray pictures. These, however, had no effect on the worker's efficiency nor did they shorten his span of life or work. It is a question whether the dilation of the lungs of the cement plant workers is so far different from the condition of that of other workers in several other industries which require great physical exertion. Observations have shown that not all cement plant workers are afflicted with dusty lungs, even those who have worked at such places for long periods.

Graphite Business in Canada Recovering from Depression

GRAPHITE MINING in Canada is reported to be recovering from the depression from which it has suffered for some years. The industry is now being established on a more healthy and favorable basis and promises well for the future.

The Black Donald mine at Calabogie, Ontario, and the Standard mine at Guenette, Quebec, are said to be producing to the full capacity of their concentrating plants. The Black Donald is marketing the greater part of its product in the United States, the Standard in Germany and in England.

In the Buckingham district of the province of Quebec, about 25 miles northeast of the city of Ottawa, the property of the North American Graphite Corp. was explored by diamond drilling during the autumn of 1925. Some promising ore bodies have been located and are being developed. The Bell and Quebec properties in the same district have recently been acquired by Ottawa and Montreal interests, and both of these companies appear to have obtained good financial backing.

Canadian graphite deposits are of good grade. The disseminated flake deposits contain on an average 15% graphite. The Black Donald is unique in being the richest known deposit in America, containing 60% graphite, and it was enabled to maintain production during the periods of uncertainty.

Canadian graphite is of high quality, suitable for both lubrication and crucible purposes. A high-grade flake can readily be produced by modern methods of concentrating and refining.

The Canadian industry has suffered in the past by inefficient methods of concentration and refining, by inexperience on the part of the promoters, and by importations of cheaply mined flakes from Madagascar and Ceylon. The first two factors having been largely eliminated, graphite can now be produced in Canada at a very reasonable price.

The present activity is due to higher prices for flake in the United States market and to possibilities of increased trade with Europe. Canadian operators have the stability of Canadian credit as an inducement to European trade.

Mining and Milling of Mica to Be Studied

THE constant demand for information on mica, and numerous new developments in the preparation and utilization of this material, have justified a broad study, and preparation of a report by the Bureau of Mines, Department of Commerce, covering all technical phases of the industry. This study has been undertaken by W. N. Myers, associate mineral technologist, attached to the Nonmetallic Minerals Station, New Brunswick, N. J. Mr. Myers is collecting data and establishing contacts with mica producers.

Proportioning Cement Raw Materials

Analytical Work and Calculations Required for Determining Proportions of Raw Materials for New Plants and for the Control of Plants in Operation

By Wm. A. Ernst and Edgar S. Ernst

Chief and Assistant Chief Chemists, South Dakota State Cement Plant

THE writers have been asked on numerous occasions by engineers, promoters and those about to engage in the building of a cement plant, whether certain raw materials would, or would not, make good cement, and it is the purpose of this paper to show more or less completely how the answer to such a question is obtained, as well as the methods of proportioning materials used by plants in operation.

William A. Ernst

There are cases on record in which carload lots of the proposed raw materials have been sent to reputable testing laboratories, equipped with the necessary machinery for making trial burnings, in order to test out their portland cement making qualities.

These tests are usually recommended by men who are vitally interested in the proposed plant and who do not know certainly that the materials selected will make portland cement. This method of assuring oneself is perfectly proper, since the promoter, engineer, or the president of the new company does not care to take the responsibility alone, if, after the plant is built, it should develop that the materials were unsuitable.

But while they are perfectly proper, these methods are not necessary today, since research has made such strides forward in recent years that it is possible to state from a study of the analyses of the raw materials whether they will, or will not, make a good portland cement without the expense of large scale tests.

The day of "rule of thumb" methods is fading away and the manufacture of portland cement is approaching an exact science. The publication of the results of scientific research has enabled the cement manufacturer to make a product that can be relied upon to pass all specifications required by the various governmental departments and societies for testing materials. The contractor, and the general public, can reasonably expect that every car that is shipped by any one plant will be fairly uniform in color, fineness, setting time and tensile strength, varying only within very narrow limits from the plant standard.

Control of quality is essentially a chemical process; therefore it is quite necessary that the cement company secure the services of a competent chemist, give him full charge of his department, and hold him responsible for results.

Portland cement is defined, according to the American Society for Testing Materials and Bulletin No. 33, United States Department of Commerce, as being "the product obtained by finely pulverizing clinker produced by calcining to incipient fusion an intimate and properly proportioned mixture of argillaceous and calcareous materials, with no additions subsequent to calcination, excepting water and calcined or uncalcined gypsum."

Edgar S. Ernst

Ingredients of Portland Cement

The essential ingredients of portland cement are silica, alumina and lime, the percentage of each being held within very narrow limits. The proportioning of the raw materials depends on their analyses. A certain mixture may be applicable at one plant and be a total failure at another. It is for this reason that careful chemical control is necessary at all times to insure a good quality of cement in any cement plant.

Portland cement may be made from a number of materials, or combinations of materials, of which the following are examples:

1. Limestone and clay or shale.
2. Cement rock and limestone.

The Authors

***WM. A. ERNST** has had many years of experience in the cement industry, beginning his career in the Lehigh district at Nazareth, Penn. Later he was with the Coosa Portland Cement Co. as chief chemist. While in this capacity he passed on many thousands of barrels of cement for use in the construction of Nitrate Plant No. 2, Muscle Shoals, and of Wilson Dam.*

At present he is chief chemist for the South Dakota State Cement Plant, Rapid City, S. D.

Edgar S. Ernst, co-author, is a university graduate and has had a varied experience in the portland cement industry, starting as cement inspector and chemist for a well-known commercial testing laboratory in 1916.

Later he became identified with the manufacturing side of the industry and has seen service in and become acquainted with all phases of the chemical and physical control of the product.

At present he is assistant to the chief chemist of the South Dakota State Cement Plant.

3. Chalk and clay or shale.
4. Marl and clay or shale.
5. Alkali waste and clay or shale.
6. Slag and limestone.

Combination 1 is the one in most general use today.

In the early days of the cement industry in the United States, especially in the district around the Lehigh valley, a cement company was considered fortunate if it could locate a deposit of high-grade limestone and cement rock. It was considered a necessity to have at hand a deposit of cement rock which was very close to a natural mix, and when this was not quite up to standard a limestone deposit for correction purposes in addition.

This naturally had a tendency to limit the location where portland cement was made. The Lehigh valley, in consequence, enjoyed an enviable reputation. However, it was not very many years before it was realized that cement of the same high grade could be made from materials other than limestone and cement rock, so long as they contained the necessary ingredients of silica, alumina and lime in the proper ratio. Combinations could be made that would produce any predetermined mix, and the resulting clinker was in every way as good as that made from limestone and cement rock.

Limestones and shales, or clays, suitable for the manufacture of portland cement, are widely distributed over the United States in great abundance, and in many cases are of remarkable purity and uniformity. This has stimulated production to such a degree that the availability of materials, which was once considered the most important factor, has been obliged to take second place.

There are many points to be observed in selecting raw materials for a new plant which may not be apparent to the uninitiated and which are not a part of the regular routine work of a plant already in operation. In doing this, the advice to carefully and thoroughly analyze all raw materials cannot be over emphasized, for on this one step alone may depend the success or failure of the plant.

In this connection, it may be well to observe that some raw materials contain ingredients which do not add to their value and which quite often may prove injurious. Among these may be mentioned free silica, phosphates and sulphates.

Recognizing the importance of having proper raw materials, it is essential that a thorough examination be made of proposed quarry sites before their acceptance. Prospecting may be done by drilling representative test holes on the property with a core drill or a well drill and subsequently analyzing samples taken every few feet during the progress of the drilling. As an extra precaution, in the case of a quarry which has already been opened up, face samples may also be taken. The analyses may then be charted showing the variations in composition at the various locations. This chart will be found to be well worth the time spent in drawing it up, since it will prove of material aid in future operations.

Portland cement in composition tends toward a tricalcic silicate, consisting of 73.6 % calcium oxide and 26.4% silica. Practice does not allow it to be made in this form, however, due to the difficulty that would be experienced in attaining the proper burning conditions. Hence fluxes, in the forms of the oxides of aluminum and iron must be added in order to render chemical combination possible at the temperatures usually found in the rotary kiln. These additions introduce their own problems since they must be kept within rather restricted limits.

The method employed to accomplish this end is to select raw materials in which the silica, alumina and oxide of iron bear such a relation to each other as to admit of such combinations as will produce the following ratios in the finished product:—

$$\frac{SiO_2}{R_2O_3} = 2.0 \text{ to } 2.2$$

$$\frac{SiO_2}{Al_2O_3} = 2.75 \text{ to } 3.0$$

$$\frac{Al_2O_3}{Fe_2O_3} = 2.4 \text{ to } 2.6$$

The magnesia content of these materials must also be low. How low it should be in one raw material depends somewhat on the content of the other in this respect. The limiting specification of 5% oxide of magnesia in the finished cement serves as a guide in determining this point. Taking the concentration experienced in passing from raw material to clinker into consideration, a limit of 3% should be set in the case of limestone, provided, however, that the amount in the shale, or other argillaceous material, does not exceed this amount.

Having obtained suitable sources of supply, the raw materials may now be combined in the proper proportions by the use of any one of several well-known formulae (to be found in any standard book on the subject of cement manufacture) such as those of Newberry, Eckel and others. These formulae are all based on the modern conception of the constitution of portland cement as made known by present day research. They differ only in slight degree, depending on the emphasis laid by the person advocating them on the relative importance of the several components of the mix.

Using Eckel's Cementation Index[1] as representative (a value of 1.07 to 1.10 is usually considered good practice),
and given raw materials of the following composition:

	Limestone	Shale
Silica (SiO_2)	1.22%	56.38%
Alumina (Al_2O_3)	.34	20.00
Iron oxide (Fe_2O_3)	.44	5.52
Lime (CaO)	54.46	.74
Magnesia (MgO)	.48	2.33
Sulphur trioxide (SO_3)	.03	1.64
Loss on ignition	42.95	12.00

in order to find the combining ratios we would proceed as follows:

Operation (1). Limestone

Silica	$\times 2.8 = 2.8 \times 1.22 =$	3.416
Alumina	$\times 1.1 = 1.1 \times .34 =$	.374
Iron oxide	$\times .7 = .7 \times .44 =$	.308
		4.098
Lime	$\times 1.0 = 1.0 \times 54.46 =$	54.46
Magnesia	$\times 1.4 = 1.4 \times .48 =$	.672
		55.132
	$55.132 - 4.098 =$	51.034

Operation (2). Shale

Silica	$\times 2.8 = 2.8 \times 56.38 =$	157.864
Alumina	$\times 1.1 = 1.1 \times 20.00 =$	22.000
Iron oxide	$\times .7 = .7 \times 5.52 =$	3.864
		183.728
Lime	$\times 1.0 = 1.0 \times .74 =$	.74
Magnesia	$\times 1.4 = 1.4 \times 2.33 =$	3.262
		4.002
	$183.728 - 4.002 =$	179.726

$\frac{179.728}{51.034} = 3.52$ parts of limestone must be added to 1.0 part of shale by weight.

But since this will give a high-limed cement, we must reduce this figure by 10%. So we have for a final ratio $.9 \times 3.52 = 3.168$ parts of limestone to 1.0 part shale. Combining these materials in this ratio should produce a good cement mixture.

Control of Operations

That which has been noted above deals more with the preliminary work of starting a plant than with the actual control of operations, but, while it may only be used at infrequent intervals, a thorough understanding of the principles involved is quite essential for obtaining the best results.

That which is to follow will touch on some of the methods employed in actual control work. The particular method used will depend on local conditions, the type of machinery used in various parts of the plant, the process of manufacture (wet or dry), etc.

$$\frac{(2.8 \times \%\ SiO_2) + (1.1 \times \%\ Al_2O_3) + (.7 \times \%\ Fe_2O_3)}{(\%\ CaO) + (1.4 \times \%\ MgO)} = 1.0$$

Eckel's cementation index

Most plants employing the dry process, in making their mixtures, weigh the dried materials separately, discharging them into a common hopper. In this case, having obtained the combining ratios (by weight) as outlined above, it is a simple matter to set the weighing device so that it will deliver the materials in this ratio. It is not so simple, however, where the mixing is done on a volume basis. In this case the weight relations, noted above, must be converted to volume relations. This can be done by dividing the weight relations by the unit

[1] Eckel: *Cements, Limes and Plasters*, p. 391.

weights of their respective materials (as determined by weighing them in the condition in which they are to be fed to the measuring device).

Example

Given:

Weight relations as above, 3.168 to 1.0
Unit weight of limestone (crushed) 125 lb.
Unit weight of shale (crushed)..... 90 lb.

To find volume relations:

$$\frac{3.168}{125} = .0255 \text{ (limestone)}$$

$$\frac{1.0}{90} = .0111 \text{ (shale)}$$

$$\frac{.0255}{.0111} = 2.318 \text{ to } 1.0 \text{ (the ratio by volume)}$$

Proportioning in Wet Process Plants

In those plants employing the wet process still other methods of combining the materials are used and these methods introduce other factors which must be taken into account. Here it is quite often the case that the argillaceous material is ground separately in a wash mill to a very thin slurry, or slip, which is pumped to the mills grinding the calcareous material, the amount being regulated by controlling the size of the discharge orifice (the supply being kept at constant head). The quantity delivered varies with the fluidity of the slip and with its moisture content.

The former variable depends on the latter but affects the amount of material delivered in unit time in reverse manner. The moisture content, therefore, serves as a guide to the relative quantity of material delivered per unit of time and to changes necessary in the size of the orifice. It should not be taken from the above that the calculations involved are as simple as those used in determining the moisture content of the slurry, for such is not the case. It is necessary to consider the character of the raw material, its specific gravity, the rate of flow of the slip, etc., but once these have all been determined, and the standard set, the variations in the amount of moisture may be used as a guide for correction purposes.

Proportioning by Setting a Feeder

Another means of making the preliminary mixtures which is applicable to either wet or dry process plants is that one which calls for a moving horizontal slide or reciprocating feeder placed under each bin containing the separated raw materials. These slides are moved by variable stroke eccentrics driven in common by a chain drive and discharge into the same hopper. The quantity (volume) of either of the materials delivered, in relation to the other, is regulated either by varying the length of the stroke of the eccentric or by varying the depth of the material on the slide by raising or lowering a discharge gate. In the case the writers have in mind, a chart was worked out showing the effect of various settings of the eccentrics on the proportions (volumes) in which the materials would be delivered with gate settings equal. (See Table 1.)

There were seven different settings possible on each eccentric, a change from one setting to the next one to it accounting for a difference of 0.25 inch in the length of the eccentric stroke. The gear ratio, in this case, was 2.571 to 1.0. It is easy to see that many combinations are possible without changing the height of the gates. In this table (1) the gates were assumed to be open to the same point. The figures represent the ratio in which the materials would be fed for any given setting of the eccentrics.

Example

In the example given before, the volume relations in which the limestone and shale would have to be combined to produce a mix were found to be 2.318 parts of limestone to 1.0 part of shale. The closest ratio to this in the table is 2.314 and is obtained by setting the limestone eccentric in the sixth hole and the shale eccentric in the fourth hole.

Temporary fluctuations from this ratio can be taken care of by raising or lowering the proper gate. In those plants equipped with correction tanks for the slurry, this may be taken simply as an approximate mix and no attention paid to small fluctuations, relying rather on the later correction to even them up.

This short outline of several methods for making the preliminary mixture is by no means all-inclusive, but it is hoped that it does show sufficient variety to give some idea of the principles involved and means for applying them.

Many of the older dry process plants made no provision for correction of the mix made at the proportioning device, relying rather on frequent checks and changes in the mixing ratio to produce in the aggregate an average meeting the set standard. While much cement has been, and is being, manufactured under such conditions, it is plainly to be seen that in the interest of uniformity of product and running conditions in the plant that some means for further mix analysis and correction would prove of great value. (This idea has been incorporated in some of the later dry process plants.)

In those plants which are equipped for correcting the mix, samples are usually taken at frequent intervals from the mill stream as the storage bins or tanks are being filled and again on the filled tanks after the material has been thoroughly mixed in them. The materials in the various tanks are then blended according to their chemical composition in such proportions as to produce the standard mix before being fed to the kilns for calcination. The method employed in determining these proportions will be found below.

With a constant, uniform mix, satisfying the ratios mentioned before, being fed to the kilns and being assured proper burning conditions, 90% of the task of making cement has been accomplished, when viewed from the standpoint of the chemist. From the clinker point on, except at one or two stages, laboratory control of the product is of more or less a physical nature as contrasted with the previous chemical control. This phase of the subject is reserved for a paper to be prepared at some future time.

TABLE 1

Limestone: Length of stroke (in.)	Setting number	Setting Number—Shale: 1 (5.75)	2 (5.50)	3 (5.25)	4 (5.00)	5 (4.75)	6 (4.50)	7 (4.25)
5.75	1	2.571	2.688	2.815	2.957	3.112	3.285	3.478
5.50	2	2.460	2.571	2.693	2.827	2.978	3.143	3.328
5.25	3	2.347	2.454	2.571	2.638	2.842	3.000	3.175
5.00	4	2.235	2.337	2.448	2.571	2.706	2.857	3.025
4.75	5	2.124	2.220	2.326	2.442	2.571	2.714	2.873
4.50	6	2.016	2.104	2.204	2.314	2.436	2.571	2.722
4.25	7	1.900	1.986	2.081	2.185	2.301	2.429	2.571

Determination of Slurry Moisture (Wet Process)

A weighed portion of slurry is placed in a tared dish and dried over a hot-plate, without spattering, until no further moisture is condensed on a cold glass plate held close to its surface. One hundred times the difference in weight, on reweighing when cold, divided by the original weight of the sample, will give the percentage of moisture in the slurry.

The point at which this should be held varies with local conditions from 30% at some plants to 40% at others, though a figure approaching the former is to be preferred. The standard is determined by trial, keeping in mind that an increase in moisture means lowered production, increased heat consumption and lower kiln-housing temperatures, items not to be overlooked, especially in those plants equipped for utilizing waste heat.

When 50 grams of slurry is used as a sample, Table No. 2 will be found convenient for ready reference.

Determination of Slurry Fineness (Wet Process)

Slurry fineness is determined by weighing out 100 grams of slurry and washing it through a 100 or 200 mesh sieve (according to whether the fineness is to be reported as through 100 or 200 mesh), the residue dried on the sieve over a hot plate and weighed. The following calculation is then made:

$$a - \frac{b}{a - c} \times 100 = \text{percentage of the solid material passing the sieve.}$$

Where a equals 100 grams = weight of the sample,
b = weight of the dried residue after washing.
c = percentage of moisture in the slurry.

The fineness necessary will be found to vary from plant to plant, also being somewhat dependent on the character of the raw materials used, cement rock not calling for the same degree of fineness necessary in the case of the materials further removed from a natural mix. Best results have been ob-

tained when the standard was set between 90 and 95% through 100-mesh sieve.

Determination of Barrels of Dry Material in a Given Quantity of Slurry (Wet Process)

It is quite essential for blending purposes, and for the estimation of the quantity of dry material delivered to the kilns, to determine the barrels of dry material in a given volume of slurry. Since the storage tanks are usually of constant cross-section, it is customary to express this figure in terms of barrels per inch of height of the slurry in the tank. For the purpose of illustration of the method employed in deriving this figure several assumptions will be made as follows:

Cylindrical tank, diameter 20 ft. (assumed).

Weight of barrel of raw material (dry), 625 lb.

Then the bbl./in. of height of slurry is obtained by the use of the following formula:

$$\text{Bbl./in.} = A \times B \times C$$

Where A = weight of 1000 c.c of slurry,
B = per cent of dry material in the slurry.
C = a constant involving the dimensions of the tank and the weight of a barrel of dry raw material.

The formula is derived as follows:

Diameter of the tank, 20 ft.
One cubic meter equals 35.314 cu. ft.
One kilogram equals 2.206 lb.

Volume of slurry in tank 1 in. in depth $= \frac{\pi r^2}{12} = \frac{3.1416 \times 10^2}{12} = 26.18$ cu ft.

Converting to cubic meters, $\frac{26.18}{35.314} = .74134$ cubic meters.

Weight of a barrel of dry raw material $= \frac{625}{2.206} = 283.498$ kg.

Then bbl./in. $= \frac{A \times B \times .74134}{283.498}$. But $\frac{.74134}{283.498} = .002614 = C$ = a constant.

Hence the above formula.

The use of logarithms in making this calculation simplifies the work attached to it.

Some chemists prepare tables showing the barrels per inch for the different percentages of moisture. While this may prove to be close enough in many instances, the additional work involved in making a separate calculation for each batch of mix is so insignificant, compared to the results obtained, that it is well worth the trouble of making it.

Chemical Control Tests

It is customary at most plants to use the percentage of calcium and magnesium carbonate (or the carbonate reduced to oxide) as a guide in controlling the composition of the mix. The amount commonly contained will vary from 74% to 77% of carbonate of lime, or its equivalent of oxide. This figure can be determined by a simple calculation involving the analyses of the raw materials and their combining ratios.

While methods of sampling may differ at different plants, the usual practice is to take samples of the mix from the mill stream for analysis. In the case of wet process plants, some of the dried sample used in determining the moisture content of the slurry can be ground to a powder and analyzed for carbonates by either the acid-alkali or the calcimeter method described in most books on the subject of cement manufacture.

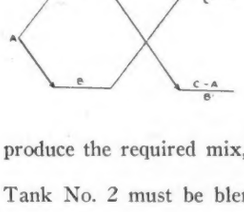
Calculation of the Exact Mix

It is assumed:

Mixture to contain 75.00% $CaCO_3 = A$.
Two tanks of slurry analyzing as follows:

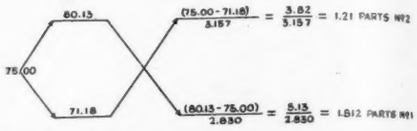
	No. 1.	No. 2
Moisture	35.8%	31.1%
Carbonate	71.18 $= B$	80.13 $= C$
Bbl./in.	2.830 $= B'$	3.157 $= C'$

If the materials were both dry, by the use of medial proportion, the ratio in which the material in the two tanks would have to be combined to produce the standard could readily be obtained. Since this is not the case, however, a further refinement is necessary. The ratios first obtained must, therefore, be further divided by the figure representing the barrels per inch of slurry of the tanks in question. The usual formula then becomes in diagrammatic form:



Or, to produce the required mix, $\frac{(A-B)}{C'}$ parts of Tank No. 2 must be blended with $\frac{(C-A)}{B'}$ parts of Tank No. 1.

Substituting values of A, B, and C:



The methods of calculation outlined above for use in the wet process are, except in a few instances which will be readily recognized, the same as those used in the dry process except that in the latter case, the materials being dry, no correction is necessary for moisture. Anyone can, therefore, adapt them for use in the dry process.

Conclusion

Briefly summarized, the essential points to be observed in starting a new plant are careful selection of raw materials satisfying the ratios set forth and present in sufficient quantity to assure continuous, uniform and economical running conditions; proper blending of these materials to meet a standard which will assure the production of a good grade of portland cement; proper burning and mechanical handling of this material and constant supervision to make certain that this standard is being uniformly met.

Aplite in Georgia

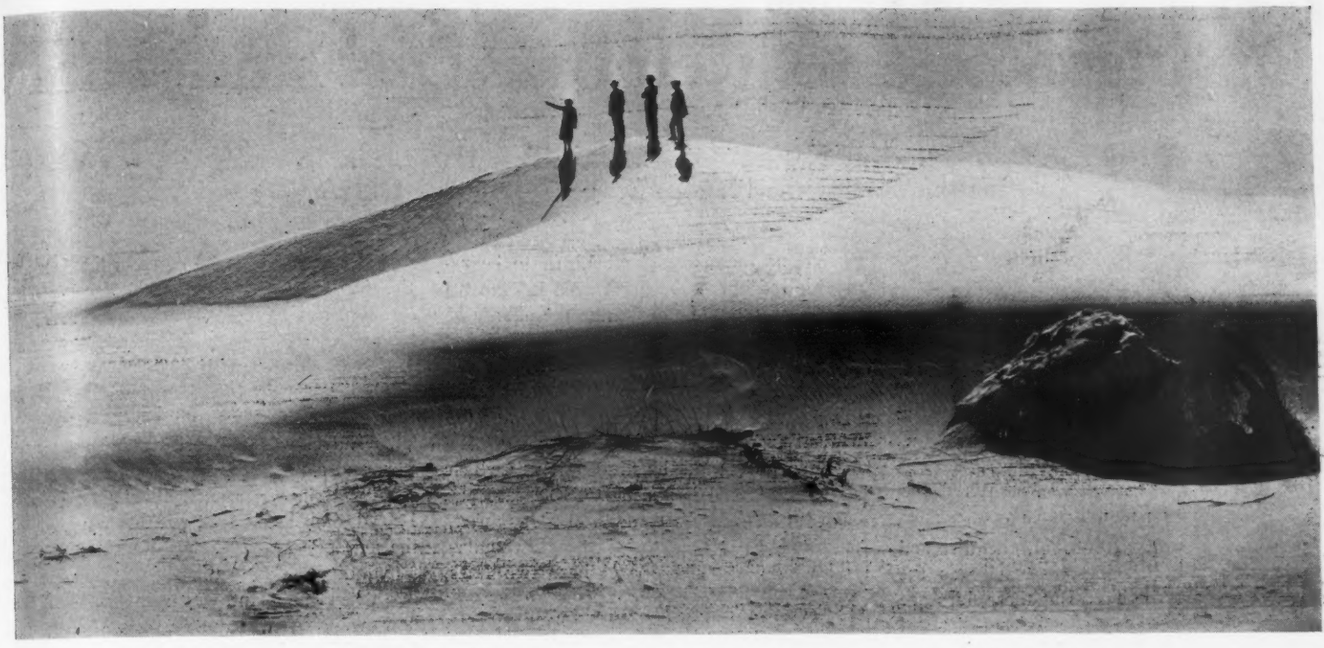
THE area along the lower edge of the Piedmont plateau in Georgia contains deposits of aplite low in iron and high in fluxes; it lies close to the vast deposits of kaolin and white sand along the northern border of the coastal plain. The supply of raw materials for the manufacture of high-grade face brick is enough to support a large industry indefinitely, according to a recent bulletin issued by the Bureau of Mines. It is ground and mixed with clay and sand to make a high grade brick.

Quarrying, transportation and grinding of the aplite rock will, of course, add to the cost of production. In comparison with face brick made from fire clays obtained by underground mining, the added cost of the flux is compensated by the lower cost at which the kaolin and sand can be mined by steam shovel.

Fuel costs are higher in the kaolin districts than in the fire-clay areas, but the extra cost of fuel is overbalanced by cheaper labor and the shorter time of burning permissible with the kaolin mixtures.

TABLE 2—MOISTURE IN SLURRY
Use 50-gram sample

Retained	.00	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75	.80	.85	.90	.95
25	50.0	49.9	49.8	49.7	49.6	49.5	49.4	49.3	49.2	49.1	49.0	48.9	48.8	48.7	48.6	48.5	48.4	48.3	48.2	48.1
26	48.0	47.9	47.8	47.7	47.6	47.5	47.4	47.3	47.2	47.1	47.0	46.9	46.8	46.7	46.6	46.5	46.4	46.3	46.2	46.1
27	46.0	45.9	45.8	45.7	45.6	45.5	45.4	45.3	45.2	45.1	45.0	44.9	44.8	44.7	44.6	44.5	44.4	44.3	44.2	44.1
28	44.0	43.9	43.8	43.7	43.6	43.5	43.4	43.3	43.2	43.1	43.0	42.9	42.8	42.7	42.6	42.5	42.4	42.3	42.2	42.1
29	42.0	41.9	41.8	41.7	41.6	41.5	41.4	41.3	41.2	41.1	41.0	40.9	40.8	40.7	40.6	40.5	40.4	40.3	40.2	40.1
30	40.0	39.9	39.8	39.7	39.6	39.5	39.4	39.3	39.2	39.1	39.0	38.9	38.8	38.7	38.6	38.5	38.4	38.3	38.2	38.1
31	38.0	37.9	37.8	37.7	37.6	37.5	37.4	37.3	37.2	37.1	37.0	36.9	36.8	36.7	36.6	36.5	36.4	36.3	36.2	36.1
32	36.0	35.9	35.8	35.7	35.6	35.5	35.4	35.3	35.2	35.1	35.0	34.9	34.8	34.7	34.6	34.5	34.4	34.3	34.2	34.1
33	34.0	33.9	33.8	33.7	33.6	33.5	33.4	33.3	33.2	33.1	33.0	32.9	32.8	32.7	32.6	32.5	32.4	32.3	32.2	32.1
34	32.0	31.9	31.8	31.7	31.6	31.5	31.4	31.3	31.2	31.1	31.0	30.9	30.8	30.7	30.6	30.5	30.4	30.3	30.2	30.1
35	30.0	29.9	29.8	29.7	29.6	29.5	29.4	29.3	29.2	29.1	29.0	28.9	28.8	28.7	28.6	28.5	28.4	28.3	28.2	28.1
36	28.0	27.9	27.8	27.7	27.6	27.5	27.4	27.3	27.2	27.1	27.0	26.9	26.8	26.7	26.6	26.5	26.4	26.3	26.2	26.1
37	26.0	25.9	25.8	25.7	25.6	25.5	25.4	25.3	25.2	25.1	25.0	24.9	24.8	24.7	24.6	24.5	24.4	24.3	24.2	24.1
38	24.0	23.9	23.8	23.7	23.6	23.5	23.4	23.3	23.2	23.1	23.0	22.9	22.8	22.7	22.6	22.5	22.4	22.3	22.2	22.1
39	22.0	21.9	21.8	21.7	21.6	21.5	21.4	21.3	21.2	21.1	21.0	20.9	20.8	20.7	20.6	20.5	20.4	20.3	20.2	20.1
40	20.0	19.9	19.8	19.7	19.6	19.5	19.4	19.3	19.2	19.1	19.0	18.9	18.8	18.7	18.6	18.5	18.4	18.3	18.2	18.1
41	18.0	17.9	17.8	17.7	17.6	17.5	17.4	17.3	17.2	17.1	17.0	16.9	16.8	16.7	16.6	16.5	16.4	16.3	16.2	16.1
42	16.0	15.9	15.8	15.7	15.6	15.5	15.4	15.3	15.2	15.1	15.0	14.9	14.8	14.7	14.6	14.5	14.4	14.3	14.2	14.1
43	14.0	13.9	13.8	13.7	13.6	13.5	13.4	13.3	13.2	13.1	13.0	12.9	12.8	12.7	12.6	12.5	12.4	12.3	12.2	12.1



These dunes are white and shining in the sunlight. The sand contains from 94% to 96% gypsum

New Mexico Has 270 Square Miles of Gypsum Sand

ALONG the line of the Southern Pacific Railway in New Mexico, near the city of Alamogordo and in what is known as the Tularosa basin, is a tract of gypsum sands which is said to cover an area of 270 square miles. Almost everyone who has traveled through New Mexico has seen it, for it is visible from the higher points at a great distance. The sand reef and dunes are white and shining and the appearance from a far mountain top is not unlike that of surf breaking on a distant sea beach.

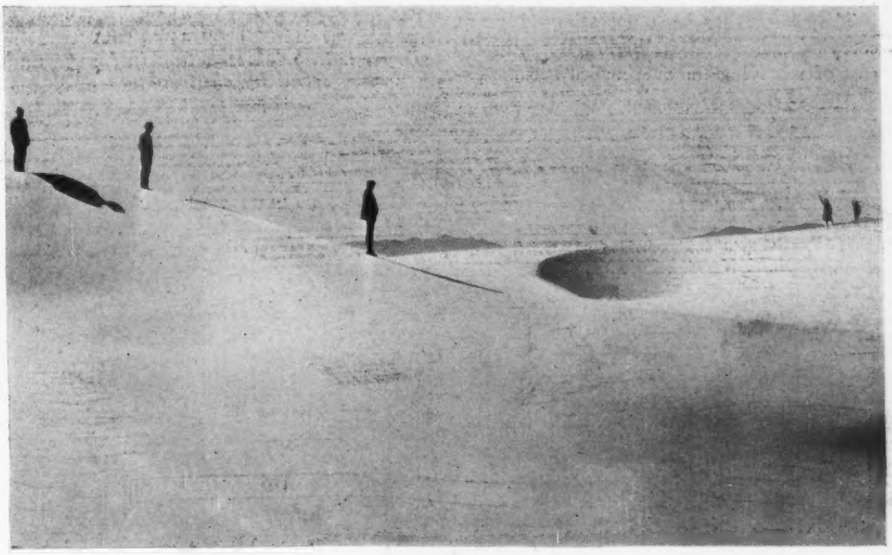
Information obtained by the Southern Pacific Railroad recently shows that these sands are almost pure gypsum. Analyses show a gypsum content of 94% to 96%. It is estimated that the deposit will run 33,000,000 tons per square mile, figuring on an average depth of 30 ft. and allowing 25 cu. ft. per ton. At some places the depth is 70 ft. Whatever method of calculation is used, the result runs into the billions of tons. It is said to be the largest known deposit of its kind, and this is probably true.

The gypsum sand forms dunes and high drifts just as any sand would in the strong winds of the desert. The wind has probably had a purifying effect, in that dust has been removed and that the sands have been blown away from other minerals.

There are various considerations which may have kept this large deposit from being worked. It is on government land and claims have been repeatedly filed on it under the placer mining act, but no work has been done and so the claims have gone back to the government or have been relocated each year. A further reason for not working these deposits perhaps is that gypsum is fairly abundant in New Mexico and deposits close to towns, transportation and water were available. Some production both of crude and calcined gypsum is reported yearly from New Mexico, and there are plants at Ancho and Acme.

A movement is now on foot to have these lands deeded by the federal to the state government and set aside for school purposes. If this should be done the state will lease the lands to a strong company and will spend the royalties on the schools.

Tourists enjoy the climb



In places where the wind has piled it the depth of this deposit is 70 ft.

Drying Stone to Remove Dirt and Shale

Abundant Natural Gas Makes This Possible at the Plant of the Hughes Stone Co., Tulsa, Okla.

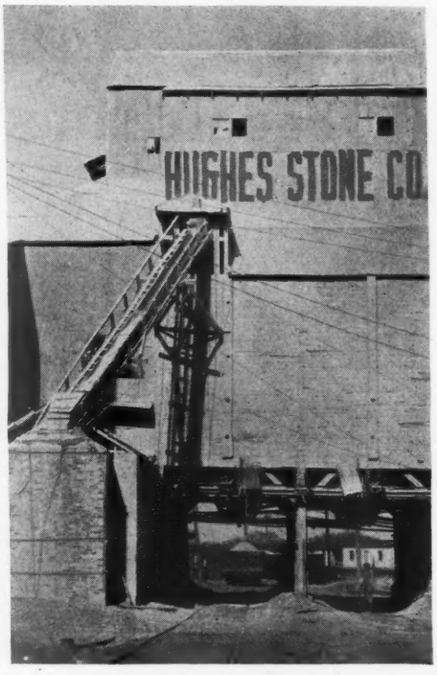
THE Hughes Stone Co., of Tulsa, Okla., operates a stone quarry about five miles from the city. The rock is limestone which was deposited in rather thin beds, from a foot to two or three feet in thickness, and between the beds are seams (varying from one-fourth to three-fourths of an inch in thickness) of shale. The rock as sent to the plant also carries a little clay and dirt from the overburden.

The rock is fairly hard and the shale in the seams is soft. Hence all the dirt and shale goes into the fines, especially as the shale seams are so thin. But these fines are valuable and they are cleaned from dirt and shale in an unusual way. They are sent to a dryer and dried until the lumps of dirt and shale break up so that they will pass a ¼-in. round hole. Passing the fines over a screen with this size of perforation gives a thoroughly clean product as an oversize and dirt as the undersize. Of course a considerable amount of fine limestone gets away with the dirt, so much that the fines are valuable as agricultural limestone. They have also been used in concrete where it was desirable to reduce absorption to the lowest degree possible. So all the products of the plants are found to be saleable.

The method of drying the fines until the lumps will break up in screening would not be possible everywhere, as the cost of fuel would be too great. But at the Hughes plant natural gas is used for fuel and the company owns the gas well which produces it. A fuel cost is charged to the plant of course, but any profits from the operation of gas well go into the same pockets as the profits from operating the stone quarry.

The quarry has been operating 11 years, carrying a face 22 ft. high. Recently the cost of removing the overburden became excessive, as there are about 12 ft. to be removed, and operations have been begun at a point near the plant to deepen the quarry 35 ft. below the present floor. The stone is somewhat cleaner at this depth and working can thus go on over an area already stripped to a depth half again as deep as the original face.

The drilling and blasting method which has been adopted is unusual. Holes are put down by a Keystone drill, 12 ft. apart, staggered, so as to make a series of equilateral triangles. There are these two lines of holes, the nearest 12 ft. from the face and the farthest 22.2 ft. from the face. (This last figure is the calculated distance from the base of the triangle to the apex, plus 12 ft.) Holes are loaded with 40% powder.



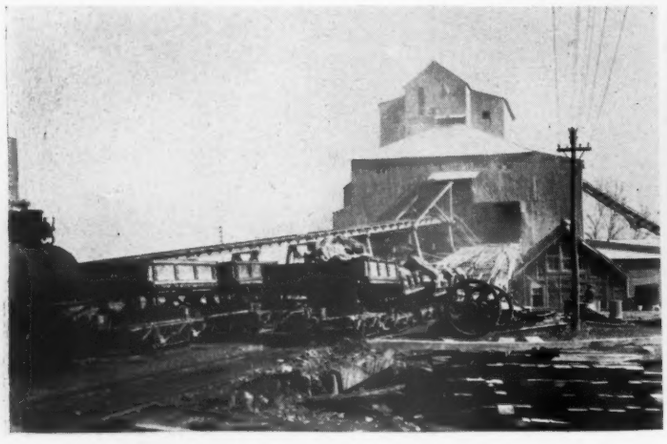
Dryer is in brick structure in foreground, fed by chute above

The broken rock is loaded with a No. 41 Marion steam shovel with a 2-yd. dipper. This shovel was at work at the old quarry face and a new No. 37 Marion electric, full revolving shovel on caterpillar treads with a 1¾ yd. dipper has been put into operation at the new quarry floor. An Erie shoved with ¾ yd. dipper was loading in the lower working when the plant was visited. Until the new working was begun this shovel was engaged in stripping.

All the haulage equipment is standard gage. There are two 21-ton locomotives, one a Vulcan, the other a Porter. The side dump cars hold 6 yds. and are of Western and Continental make. In the newer workings a 3-yd. end dump car is used which is pulled directly from the Erie shovel up an incline. It is of the self-dumping type shown in Hints and Helps for May 2, 1925. Regular haulage equipment will be used in these workings when they are developed.

Block holing is done by Chicago Pneumatic Tool Co.'s hammer drills and a compressor made by the same company with a 50 h.p. Westinghouse motor, furnishes the air for them.

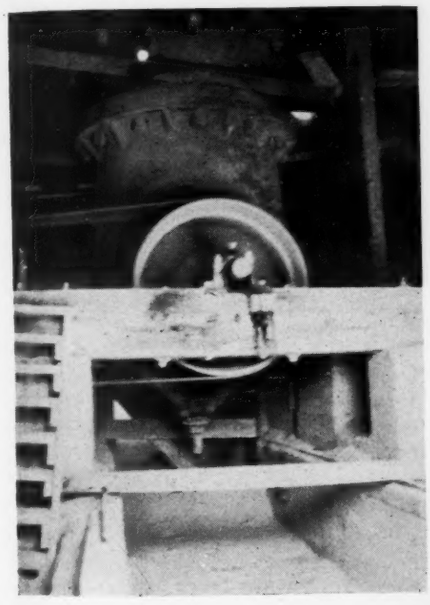
The 6-yd. cars are also pulled up an incline after being detached from the train and are dumped to the primary crusher which is a No. 9 Austin. The crusher output is elevated to the scalping screen which makes three products. The oversize goes to a No. 7½ crusher (Austin), the intermediate size to a Symons disc crusher and the fines, which pass a ¾-in. hole to a conveyor that takes them to the dryer. The dried product,



End of plant showing two inclines

Working in older part of quarry

Plant of Hughes Stone Co., with dryer furnace at the left



No. 9 primary crusher

the Symons disc crusher product and the product of the No. 7½ crusher are handled by a 36-in. bucket and belt elevator with two sets of buckets side by side. One set discharges to the sizing screen and the other to the scalping screen. This is so that the fines can be held in circulation between the dryer and the screen as long as is wanted. Eventually the fines are sent to the sizing screen.

The oversize of the sizing screen is sent to the Symons disc crusher and the other sizes go to bins.

The dryer is a Bonnot cylinder, 60 ft. long and 10 ft. in diameter. It is very substantially made and mounted so that the repairs on it have been slight. It had been used at another plant before it was installed in the Hughes plant.

All the machines are electrically driven, in the main by General Electric motors. There is an excellent switchboard installation and all machines are stopped and started from this board. Emergency stops are placed near every machine for use in case of accident or to prevent accidents. This is all General Electric equipment.

As the material is loaded from the bins into cars it is given a final cleaning by being run over conical screens with ¼-in. round hole perforations. These screens are placed below each bin. They are all on the same shaft and driven by a mitre gear at the

Dryer 60 ft. long and mounted like a cement kiln

New workings where quarry is being deepened

end of the shaft. Below the screens is a belt conveyor that takes the undersize back to the screenings bin.

Each chute from a bin discharges into the small end of a screen so that the oversize travels downward on the slope of the screen. The oversize falls from the screen into cars. This device was put in after the plant had been running for some time and it is an excellent example of close construction to save head room. By the use of these screens any dirt which may have adherred to the coarser pieces which were not cleaned by passing through the dryer is shaken off and carried away.

The system of cleaning which has been described here is efficient and one could not ask for a cleaner product than it turns out. The alternative would be a washing plant which might do as good work but would leave the stone wet and bring up the question of disposing of the water and the waste it carried. Situated as the company is, with its cheap fuel, the drying and screening process probably is the better way. Mr. Moore, one of the company who looks after the quarry operation especially, thinks it would be profitable to dry the fines even if oil had to be purchased. Only about a third of the product has to be dried and in dry weather it is not necessary to use much heat. Sometimes the rock dries sufficiently by the sun. One great advantage that has been found since installing the dryer, is that rain does not interfere with the work. Before it was installed the quarry had to be shut down after a rain to allow the stone to dry.

The installation has attracted much attention from crushed stone men in other parts of the country who have visited the plant to see it or who have written to the company for information concerning the process. Where fuel is cheap there might be other localities in which it could be profitably applied as a substitute for washing. A company in Texas is said to be making experiments with the method. Of course drying and screening to remove dirt has been practiced for centuries wherever mining and quarrying were carried on in regions of little rain. The adaptability of the method to any particular quarry depends upon the local cost of fuel and labor for drying.

The Hughes Stone Co. is one of a group of industries which are owned and controlled by J. M. Chandler, F. T. Glasscock and W. A. Moore. The offices are in the Mayo Building in Tulsa.

Switchboard from which all motors are started and controlled

Principal World Sources of Asbestos

CANADA, it is estimated, furnishes more than 80% of the world's production of asbestos. The Asbestos Corporation of Canada (Ltd.) and three companies controlled by American capital are credited with 80% of the Canadian output. The Asbestos Corporation, owning the newest and largest mill, is at present the largest single producer, but the three American companies each contribute an important proportion of the total.

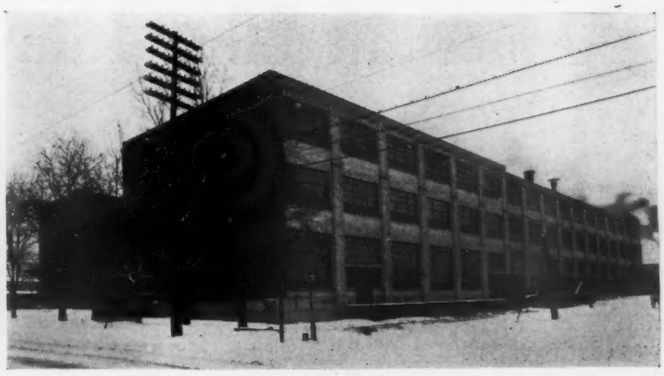
During the last quarter of 1925, seven of Canada's asbestos companies agreed to merge. This amalgamation — designed to stabilize prices, eliminate price cutting and effect economies in production by unified operation —had been in the process of negotiation for several months. The constituent firms will be operated by the Asbestos Corporation (Ltd.), the other members being Black Lake Asbestos and Chrome Co. (Ltd.), Thetford Vimy (Ltd.), Consolidated Asbestos (Ltd.), Federal Asbestos Co., Maple Leaf Asbestos Corporation (Ltd.) and Asbestos Mines (Ltd.). The seven companies operate 17 mines in Quebec. Their total output in 1924 amounted to 102,995 tons, or 45½% of the Canadian production, and sales aggregated 102,677 tons valued at $3,041,498. The 1924 production of companies which will continue to operate independently totaled 123,302 tons, of which 122,895 tons, worth $3,577,432, were sold or shipped.

The next largest production of asbestos is in southern Rhodesia, which reported an output of 18,182 tons in 1923, 23,340 in 1924 and 27,994 in the first 11 months of 1925. Foreign shipments aggregated 17,412 tons in 1923 and 23,561 in 1924, Great Britain taking 16,884 and 18,661 tons, respectively, in the two years.

Most of the Rhodesian asbestos is of the chrysotile variety and until recently production was entirely by hand processes. Some of the companies have now installed treatment plants suitable for operations on a larger scale.

The Union of South Africa produces almost as much asbestos as Rhodesia and has a considerable range of varieties, including chrysotile, crocidolite, amosite, asbestic and tremolite. Domestic and foreign sales of the Union's production in 1924 were reported at 6253 tons, and in 1925 at 9079. Production for 1923, the latest year for which this figure is available, amounted to 7312 tons, and exports totaled 8847 tons. Exports for 1924 are recorded at 5896 tons.—Consul C. B. Hosmer and Consul C. M. P. Cross, in *U. S. Commerce Reports.*

Haynes Ionia Building. The smoke stack is of sand lime brick as well as the main structure



The Macy factory; interesting because it is an addition to a clay brick building

Sand-Lime Brick Production and Shipments

IT is the intention of Rock Products to publish hereafter satistics which will show the growth and progress of the sand lime brick industry. The more important plants of the country have promised reports from which the necessary data may be taken. The first month for which reports were made was April, and as the system of reporting had not been well established at that time, complete reports were received from only four plants. The table which follows shows the state of the industry only so far as these four plants are concerned:

Production, April, 1926	3,930,000 bricks
Shipments by Rail	3,237,000 bricks
Shipments by Truck	1,120,510 bricks
Stocks on Hand	2,795,000 bricks
Unfilled Orders	5,300,000 bricks

The average price obtained was $12.90 delivered on the job. Plant prices were stated to run $1.35 to $2.75 lower than the delivered price.

As is the case with most building materials, the season has started rather slowly, although prospects are for a fair year's business. The delay is set down mainly to weather conditions.

On this page are shown buildings built of sand lime brick made by the Grande Brick Co. of Grand Rapids, Mich. Some of these buildings have an interesting history as showing the strength and permanency of sand lime brick as a material for the better class of structures.

Furniture Temple, Grand Rapids, Mich.

The Elks temple took a half million brick and was built in the dead of winter, the basement being filled with ice and snow much of the time it was under construction. Sand lime brick was used to bring the basement to the grade line, and not a brick was injured by the severe weather conditions.

The Macey factory took about 500,000 brick and it is an interesting job because it was an addition to a clay brick building.

The Haynes Ionia Co. building took about 2,000,000 white and 200,000 red sand lime brick. No other brick was used in its construction. The smokestack which shows in the picture is also built of sand lime brick.

The Century Furniture building was built of sand lime brick in 1910 and a sand lime brick addition was built in 1925.

Average May Prices of Sand-Lime Brick

	Plant Price	Delivered
Boston, Mass.	14.50	17.00
Milwaukee, Wis.	.....	13.00
Minneapolis, Minn.	10.00	12.75
Toronto, Ont.	13.10	15.60
Saginaw, Mich.	13.00	.....
Detroit, Mich.	14.00	17.50
Jackson, Mich.	10.00	12.00
Flint, Mich.	12.50	.....

Century Furniture Building, an important commercial structure

The Elks Temple, which was built in the severest winter weather

American Lime Kilns, Old and New

Design and Practice Have Developed in Little More Than a Generation

IN the May 29th issue of ROCK PRODUCTS the evolution of the French lime kiln was traced through the 40 years of its development, beginning with the simplest form of pot kiln and going on to the most modern type of internally fired shaft kiln with its elaborate arrangements for regulating draft and recovering waste heat.

The same evolution has gone on in the United States, although the stages are perhaps less plainly marked; that is, some of the intermediate steps may have been left out. But we have come a long way from the kiln which was accepted as the standard only a generation ago. On the opposite page the upper left-hand illustration shows the lime kiln in one of its oldest forms, and practically the only form known 50 years ago. This was the lime kiln that was often used in the old fiction as a haven for the weary traveler caught out on the moor in a rainy night. Its losses of heat by radiation, while they made it comfortable for the traveler, did not speak well for its efficiency as a heat conserver. This particular picture was taken in eastern Pennsylvania, where many such "farmer kilns" were once in use, and the last in that locality went out of service quite recently.

The picture at the right of this shows a battery of pot-kilns built about 35 years ago and representing what was the standard practice of the time. The picture is sufficient evidence that in those days fuel economy was not much of a consideration. However, lime plants could make money in those days with such a consumption of fuel and a use of labor to handle materials as would put them out of business today.

The kiln in the upper center corresponds to one of the intermediate types in the French article in that the pot of the older type had become a shaft, with the advantage of saving considerable heat. And the kilns below and to the right represent an American design of the internally fired shaft, the type more common in Europe than in the United States. This kiln stands in a mining district of the Southwest and it is natural that it should somewhat resemble the blast furnaces used in that locality for the smelting of copper and lead. It uses anthracite and coke for fuel, and owing to its low fuel consumption it produces lime which sells as cheaply as anywhere in the United States.

The lower group shows four forms of modern American kilns, all designed by well-known engineers who have specialized in kiln building. Two are fired with producer gas and two with solid fuel. They represent the modern American lime kiln (except for the rotary kiln) at the present stage of evolution and show that we have come a long way from the old pot kiln pictured above. But it would not be correct to say that the evolution of the kiln must stop at this stage. Research in lime burning is being carried on more intensively than ever before in the hope of improving both the efficiency of the kiln and the quality of the lime produced. Important large-scale experiments are being carried out. It is only natural to suppose that another stage of kiln evolution will result from so much study and investigation. As an example of this one has only to read the paper given by Mr. Azbe before the National Lime Association, reported elsewhere in this issue, in which a kiln design has been worked out from an intensive study of heat losses in lime burning.

Refractory Hydraulic Cement for Lining Lime Kilns

A HYDRAULIC cement which possesses the qualities of a good refractory material for lining lime kilns is described in a recent issue of *Chimie et Industrie*. A mixture of one part of fused alumina cement and two parts of calcined and ground bauxite on mixing with 22 to 30% of water begins to set in one hour and is completely set in four to six hours. It hardens very rapidly and is found to have a compressive strength of 145 kg. per sq. cm. By addition of old refractory brick, crushed, screened and washed it can be made into concrete and handled as portland cement concrete.

After setting of the concrete, tests show that it softens at 1350 to 1400 deg. C. and melts at about 1600 deg. C. The compressive strength decreases in accordance, but even above 1350 deg. C. the material does not flow. Both the cement and concrete have a very small shrinkage and are very resistant to sudden changes in temperature. Rapid cooling from about 1400 deg. C. to 20 deg. C. showed no cracks. Strength tests on cold concrete after heating show some friability, but this decreases with the proportion of bauxite in the mixture. Friability may be eliminated by a preliminary heating to about 1200 deg. C. and can be reduced by the addition of powdered flint or sodium silicate, but these latter lower the softening and melting points.

It has also been found that by using an aluminous cement prepared by clinkering instead of fusing, the melting point of the cement-bauxite mixture is raised about 50 deg. The presence of titanium oxide in the bauxite up to 3% is said to cause no trouble.

The Move to Widen Concrete Highways

PRESENT concrete highways are daily proving themselves incapable of carrying the peak loads of traffic near our large cities. S. T. Taylor, vice-president of the American Road Builders Association, points out that this is partly the result of the increase in automobiles which now number nearly 20,000,000. Mr. Taylor adds:

"The adoption of wider highways is becoming very noticeable in the eastern states under the present program of construction. There are many roads with four traffic lanes already completed, and a few between the larger cities where six and eight cars may be accommodated conveniently. Under the present program many of the highways already completed will be widened, while others heretofore unimproved will be paved over an unusual width.

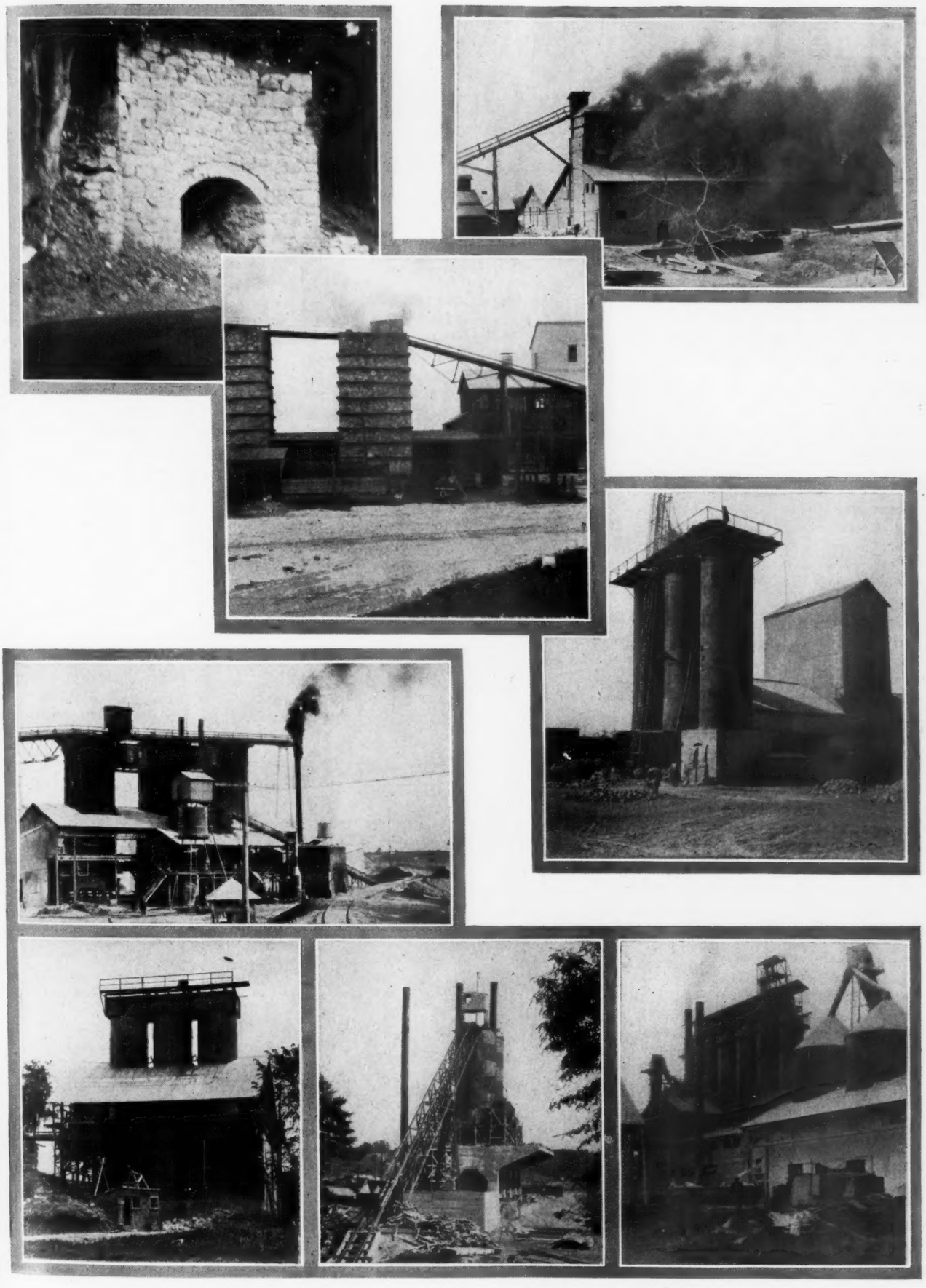
"The adoption of wider highways, equipped with modern safety devices, is essential to the welfare of motorists and in conformance to the most rigid principles of economy. Improved highways are not merely a convenience; they are also a necessity. Exhaustive experiments have shown them to more than pay for their construction in saving to the motorists, and since they are essential they should be constructed scientifically to incorporate all possible measures of safety, convenience and durability."

The move for wider highways has the backing of the American Road Builders Association, which indorsed it at a recent convention. A general widening program is bound to have an important effect on the market for portland cement and aggregates.

Diaspore Tends to Displace Bauxite in Refractories

THE use of bauxite for the production of highly refractory bricks and other articles has decreased markedly in recent years, according to Robert J. Anderson in *The Mining Journal*. Refractory makers in the United States have turned to high-grade clays, bauxitic clays, and diaspore for making bricks and other products. Employment of bauxite has not, however, been altogether discontinued. The development of high-alumina refractories has been retarded by difficulties in manufacture, particularly by difficulty in removing the fire shrinkage in bauxite. It is claimed that the excessive shrinkage found in bauxite refractories does not take place in the diaspore refractories, and that the development of these latter is one of the outstanding features of the ceramic industry in the last 25 years.

Diaspore is a hydroxide of aluminum, and is commonly found with corundum or emery. In the United States it is found in Chester County, Penn.; at the emery mines of Chester, Mass.; in cavities in massive corundum near Franklin, N. C., and with alunite at Mount Robinson, Colo.



Some examples of American lime kilns showing the development of the past 50 years

Lime Industry Surveys Its Shortcomings and Its Opportunities

Annual Convention at French Lick, Indiana, Has Well Organized and Constructive Program

THE National Lime Association re-elected its officers before closing the convention at French Lick Springs. Charles Warner is president and J. J. Urschel, vice-president. The names of directors will be given in the report published June 26.

WHEN the leading subject of discussion at a national convention is "What Is Wrong With the Industry?" it may safely be presumed that the answer is "nothing," or "something." If the correct answer were "nothing," it is doubtful if the subject would have been presented in the form quoted; so it may be accepted as self-evident that there is *something* wrong with the lime industry in the eyes of its progressive manufacturers.

The chief thing wrong with the lime industry appears to be a lack of common ground for co-operative promotional and research activities, due to the great diversity of uses of lime and the conflicting opinions of lime manufacturers as to what particular uses are most essential to the well-being of the industry. Of course, this condition was forseen by many members of the National Lime Association at the time it was reorganized, a few years ago, with a research and promotional staff at Washington, D. C. However, any fair observer, either in the association or out of it, must bear witness that good progress has been made notwithstanding difficulties to be met with such as very few other industries ever have to encounter.

The program of the annual convention of the lime industry at French Lick, Ind., June 8-10, was splendidly organized and executed to drive home to lime manufacturers both the opportunities and the shortcomings of the lime industry, and no one who was present can have gone away without a lasting impression that failure to sieze these opportunities will be a serious reflection on the lime industry as an organized group of manufacturers.

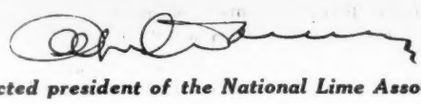
Trade Promotion and Its Relation to the Markets for Lime

Irving G. Fellner, business manager, McGraw-Hill Publishing Co., New York City, presented an illuminating and impressive analysis of the market possibilities of chemical lime, prefaced with an illustrated talk on the methods of approach to industrial organizations to develop these market possibilities. By the help of charts he gave an admirable lesson in the principles of industrial sales promotion, with particular emphasis upon the use of advertising in industrial or business papers to assist sales promotion. Incidently he showed that since the active promotional efforts of the National Lime Association began about 1921, and a few chemical lime manufacturers began advertising in chemical journals, the rate of increase in the use of lime in the chemical industries had been more than the rate of increase in production of the chemical industries themselves. In other words, there was greater consumption of chemical lime than would have been the case if the consumption of chemical lime had paralleled the output of products of the chemical industry, as was the case prior to 1921.

Of an entirely different character, but equally inspiring in helping to visualize the future market possibilities of lime, was a paper by J. P. Mollenkof, superintendent of construction for John H. McClatchy, a professional home builder, of Philadelphia, Penn. A brief abstract of Mr. Mollenkof's paper appears elsewhere in this issue. In the discussion of his paper, in answer to various questions, he said he had really found less encouragement and more skepticism on the part of lime manufacturers themselves, particularly the smaller manufacturers, than from any other source. He is a great believer in lime stucco, plaster and mortar, and his belief is based on a careful study and first-hand investigation of the subject. Examining and collecting old plaster and stucco is his particular hobby. Mr. Mollenkof said he had never had a lime salesman call on him, and that he used lime only because he was convinced that it was the best and most economical material for his purpose.

Other subjects on the program and brief abstracts of the papers follow. Victor J. Azbe's presentation of his studies of heat distribution in lime kilns and the evolution of "ultimos" will also be found elsewhere in this issue. This precipitated a live discussion which will be reported in some detail in a later issue.

This issue of Rock Products goes to press while the convention is still in session, so that we shall have to forego a more complete report of the convention until our June 26 issue.



Re-elected president of the National Lime Association

Practical Topics Are Discussed at Lime Convention

High Points of Addresses and Papers Presented Before National Lime Association

The Practical Aspects of Research

By G. J. FINK

Director, National Lime Association Laboratories

RESEARCH is always found in both the vanguard and rear guard of safe and successful promotion of any product. A research department must furnish a continuous supply of unquestionable information and data to be passed on to other departments and to members and users. Facts must be available in order that reliance may not have to be upon precedent alone.

The laboratories of the National Lime Association comprise three closely related units—namely, chemical, physical, and research extension—and a three-fold function is performed in the initiation of research, in the investigation of problems suggested by other departments, members and consumers, and in the miscellaneous service offered manufacturers and users. These activities involve routine testing, laboratory and field investigations, fundamental research, and surveys of scientific and technical literature.

As examples of the specific services offered by the research laboratories, the Construction Department is furnished with experimental and test data on mortars, plasters, concrete and other structural materials and products, properties of satisfactory plastering sands, etc.

For the Highway Department, soils and asphalts to be treated are tested and data on the effect of lime are supplied. This relatively new activity will undoubtedly uncover many questions which research alone can answer.

The Industrial Department is supplied with information of the properties and functions of limes as related to chemical and industrial processes, such as pulping of wood, absorption of gases, trade waste treatment, manufacture and use of insecticides, and some 600 other uses.

The Publicity Department is furnishing abstracts of scientific literature and digests of technical developments in connection with lime processes and uses.

In the field of research extension, cooperative investigations are arranged with users and with manufacturers of equipment for processes using lime, and fellowships are maintained and cooperative research is initiated in various institutions and industrial laboratories. New methods are developed, specifications are established, illustrative and lecture material is furnished chemical courses, and attention is continuously directed toward lime as a chemical raw material and intermediate.

The rapidly increasing use which is being made of technical information and data by lime manufacturers and salesmen, by lime users and by investigators is a favorable index of increased appreciation of lime, and the 50% increase during the past year in the number of lime plants employing chemists indicates the increasing desire to improve products and to sell service. All such developments must necessarily elevate the plane of the industry and unquestionably react favorably upon both producer and consumer.

There Is No Substitute

By J. S. ELWELL

Manager Construction Department, National Lime Association

LIME is indispensable in construction. It has always been used, it is used today, and will be used whenever and wherever permanent and economical building is done. Its construction uses fall into the four main classes of stucco, plaster, mortar and concrete, in each of which special advantages are noted. Stucco, which is fundamentally a covering to conceal and protect other construction, must be composed of material which will withstand all weather conditions. That lime stucco meets all these conditions has been demonstrated in all sections of the world and in all ages. Lime stucco is not only durable but is economical. It may be finished in any desired texture or color, and the ease with which it works makes possible uniformity in the appearance of the finished coat.

No use of lime is more important than interior plaster. It has been proven in the laboratory and in the field as well that lime plaster protects metal from corrosion, is a fire retardant, and is the most efficient for sound insulation. Lime mortar was the first mineral binder used by man when he started to build, and has continued through the centuries as the best mortar material. Its durability is established, its strength is greater than is required under the types of construction now in common use, its economy is great, and its plasticity is necessary.

Lime plays an important part in good concrete construction, in which it acts as a lubricant, facilitating placing and at the same time preventing segregation. It makes the concrete permanently water-tight. In the field it makes possible the use of less water in mixing structural concrete, and, as is well known, this reduction in mixing water increases the strength of the concrete. Concrete containing lime is more uniform in the forms than concrete without. The stresses induced by variation in the moisture content of hardened concrete are materially reduced when lime is added, and a smoother, more uniform and lighter colored surface is obtained.

Substantial and Economical Construction

By J. P. MELLENKOF

Superintendent of Construction, John H. McClatchy, Philadelphia, Penn.

THE John H. McClatchy organization has always been interested in giving the public the most satisfactory home that can be built for the price involved. This has of course necessitated considerable experimental work to determine what materials were most durable and economical. Lime has been found most satisfactory for our mortar, plaster and stucco work.

All plaster and stucco are mixed in a central mixing plant and delivered in trucks to the job as needed. Also, considerable mortar is sent out in the same way. The central mixing plant runs every working day in the year. During the coldest months about 60 bushels of lime are used each day, and during the balance of the year on an average of 150 bushels of lime is slaked and used each day, four men being enough to run the plant at all times.

The first or scratch coat of both the plaster and stucco is gaged with portland cement to speed up the set. In plaster work the second coat is applied before the scratch coat has hardened, using a lean mix. This is found to be entirely satisfactory on all types of backing, including metal lath. On stucco work, however, the scratch coat is allowed to harden for two days before the second and finish coats are applied.

Any type of finish can be secured with the lime mixes used, and the labor and material costs are kept to a minimum.

Lime in Concrete Highway Construction

By C. R. STOKES

Manager, Highway Department, N. L. A.

ONE of the greatest enterprises, if not the greatest, in this country today is the construction of concrete streets and highways to provide adequate and safe transportation facilities for the ever-increasing number of motor vehicles. These streets and highways must be permanent, and the best that money can buy. Those most concerned—the public, the engineer, and the contractor—are vitally interested in any factor

which will assure of permanence and quality of construction. Such a factor is hydrated lime, which has proved to be a tremendous asset in securing good concrete. Several states and a large number of municipalities have discovered the many advantages of lime in concrete and have been consistently using it in their concrete pavement construction for some time.

Data collected during 1924 and 1925 in Wisconsin, Louisiana, Ohio, Connecticut, Virginia, Delaware and Massachusets show conclusively that lime makes the mix more uniform, holds the water cement ratio more nearly constant, improves the finish and riding qualities of the road, and imparts the same or greater strength to the concrete. All of this contributes toward the security of the highway investment and benefits the general public, the contractor and the engineer.

Lime in Earth Roads

By H. W. WOOD, JR.

Highway Department, National Lime Association

THE experiments conducted on the effect of lime in earth road construction which have been conducted by various organizations, including the National Lime Association, for the past two and a half years, have shown gratifying success. It has been found that the lime treatment greatly stabilizes heavy clay and silt soils.

A practical test to guide authorities in making definite recommendations as to how much lime should be used has until recently been lacking. Work at Ohio State University under the supervision of Professor Eno has developed the desired test. It consists of placing the soil in a 3-in. hollow steel cylinder and forcing it through a 1½-in. circular opening at the bottom by means of a plunger, loaded in a testing machine. When the soil holds a definite percentage of water, the load required to force the soil through the hole is a measure of its stability, or resistance to deformation under load.

Untreated soil containing about 25% of water generally fails under traffic, but when treated with lime a soil containing 30% of water shows twice the stability of the same untreated soil with 25% of water.

Large-scale road tests are now under way to determine the efficiency of lime-treated earth as a base for thin gravel wearing surfaces and also as the base for oil treatment, the preliminary results having been found encouraging.

Opportunities in the Industrial Field

By L. B. BURT

Manager Industrial Department, National Lime Association

IN this discussion of the opportunities it was pointed out that lime is more economical than any other material possessed of similar chemical properties. Opportunities, however, are only profitable when they are developed, and it was pointed out how advantage might be taken of many new fields, and how better use might be made of some of the existing opportunities. Industrial processes are developing at an increasing rate and it is only by keeping abreast with these developments that lime will continue to be the leading base in chemical practice.

The use of lime has enjoyed a substantial increase in water softening and purification practices, and the immediate future looks even better than the past. Municipal water softening has trebled in the past three years and there is every reason to believe that the rate of increase will continue to be accelerated for some years to come.

In the treatment of trade wastes lime is destined to function very largely as a neutralizing and precipitating agent, in some cases assisting in the production of commercially valuable by-products. Progress is reported in the treatment of coal mining, creamery, tannery and steel mill wastes. The activity of all state boards of health is directed toward an early solution of the trade waste problem, and the Lime Association will be glad to cooperate in such work. A very important development along that general line is reported from the oil fields, where stream pollution by wastes carrying salt water have for years been a serious matter. This development, in which lime performs an important function, solves the pollution problem and converts the waste into useful products.

Balanced Publicity

By R. P. BROWN

Manager, Publicity Department, National Lime Association

THE preparation of publicity for an industry as large and as diversified as the lime industry calls for careful balancing. There are seven points of basic importance, at each of which a balance should be struck. They are:

1. Balance as to type of material.
2. Balance as to subject matter.
3. Balance as to readers.
4. Balance in departments.
5. Balance between departments.
6. Balance in the association.
7. Balance between association and members.

It is the function of the association to assemble data, work them into form and make them available to the public. This may be through the medium of bulletins, articles, folders, films, news sheets or press releases. The bulletin is most important, and the semi-technical type of bulletin may be considered as the backbone of the whole program, for from it all the other types of publicity may be developed.

As lime plays a part in all branches of modern life, so should data on it reach all classes of readers. The problem is to prepare the information in such form that it will be acceptable to each group and then to see that it reaches the group in such a way as to be of the greatest good to all. The final balance is achieved through the cooperation of member companies and the association in distributing literature, the members handling all material which goes directly to prospective purchasers, and the association sending out the purely technical material, together with such publicity as is broadcast, namely, articles and press releases.

Characteristics of Diatomaceous Earth

DIATOMACEOUS earth, when pure, is usually white, but may be dark colored from the organic matter that has not yet disappeared, states C. E. Davis, in serial 2718, recently issued by the Bureau of Mines. Impurities may cause the material to have any one or more of a variety of colors such as gray, brown, pink or green. Due to its method of formation diatomaceous earth is usually soft, very friable, and of low apparent density, being filled with billions of microscopic air cells, but due to various geologic conditions a single deposit may contain all gradations from a loose mass to material which has been altered to hard compact flint. Over 4,000 different forms of diatoms have been classified and although many of these forms are extremely small, a magnification of 200 to 500 diameters shows that the skeletons give the appearance of having been elaborately carved and ornamented with delicate tracings. A few diatoms are as large as the head of a small pin but the great majority are microscopic. Each skeleton consists of two exact counterparts fitting one upon the other like tiny pill boxes and the shape, size and condition of these particles give to diatomaceous earth the physical characteristics that determine its commercial application. Among the important physical properties are: extreme porosity, making of the material an excellent filtering medium and a poor conducter of heat and sound, and giving it high absorbent power, to which decolorization, clarification, and detergent effects are due; the large surface affording a support for catalysts; innumberable minute enclosed air cells, which remain intact on reduction of the mass to a powder, the angular nature of the diatoms, their weakness and low compressive strength, making it an abrasive which does not scratch.

It has been demonstrated that such brick can be burned safely to cone 8 to 9 in 36 to 54 hours in a test kiln holding 200 brick.

The interest in diatomaceous earth and the many new uses that have been found for it recently are causing prospectors to look for it in far western states and to locate deposits when found.

Heat Distribution in Lime Burning and Evolution of "Ultimos" Kiln

A Paper Read at the National Lime Association Convention Developing a New Design of Kiln

By Victor J. Azbe
Consulting Engineer, St. Louis, Mo.

CHART 1 gives graphically the approximate distribution of heat in the great majority of lime kilns operated today. It will be noted that a very small percentage of the heat stream entering the kiln leaves it as useful heat, only about 33%, which corresponds to a ratio of three tons of lime per ton of 12,500 B.t.u. coal. Most of the heat losses are due to evaporation of moisture in

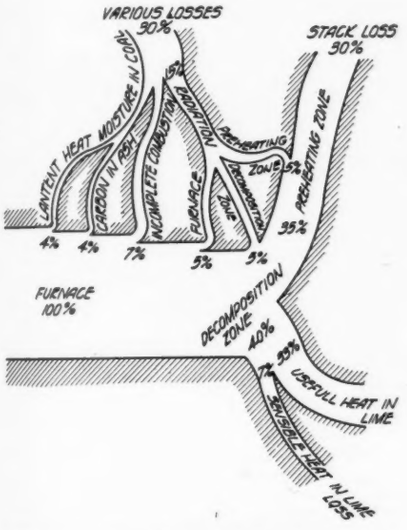


Chart 1—Showing the distribution of heat in ordinary lime kilns

coal, carbon in ash, and incomplete combustion; some heat is lost in the form of sensible heat in the lime withdrawn from the kiln, a great deal is lost by radiation from the furnace walls and the walls of the decomposition, cooling and preheating zones. But the greatest is the stack loss, sensible heat of the gas passing out of the kiln.

High and Low Temperatures in Lime Kilns

Heat in the lime kiln is of two kinds, of high and low elevation. The first will make lime, the second will only preheat limestone. With high calcium limestone, 1600 deg. F., the decomposition point, might be considered a division point. Below this all heat is of low elevation and will not make lime while above this point, heat will make lime until it is reduced in temperature to around 1600 deg. F. This should be kept clearly in mind if full benefit is to be derived from reading this paper. Previous reading of the paper, "Factors Governing Lime Kiln Capacity and Fuel Economy," delivered before the National Lime Association in 1925, would also be advisable.

OF all the papers which are being presented at the convention of the National Lime Association as this is written, probably none will receive more attention or arouse more discussion than that given here. Whether the reader agrees with Mr. Azbe's conclusions as to what is the "ultimos" in kiln designs or not, he must admit that the method is correct. It is in line with the development of improvements in all important industries to study what patent attorneys call "the present state of the art," to find out what is lacking and to devise an improvement as the result of such study. It is not often that the process is presented in such a way that the reader may follow it step by step as he can in the article presented here.—The Editors.

How some of the heat losses shown on Chart 1 may be reduced is fairly well known and need not be gone into here at great length. It may be well, however, to comment on them briefly.

The loss due to latent heat of moisture in coal or air cannot be reduced unless the amount of moisture is reduced, over which generally there is very little control. This heat may be considered of high elevation and all saved would appear as useful heat in lime.

Carbon in ash loss can be reduced by proper firing or by proper firing equipment. Too great importance should not be attached to this loss, otherwise the stack loss due to excess air may be increased. The heat in carbon is of both high and low elevation, consequently, a saving of say 2% here is not

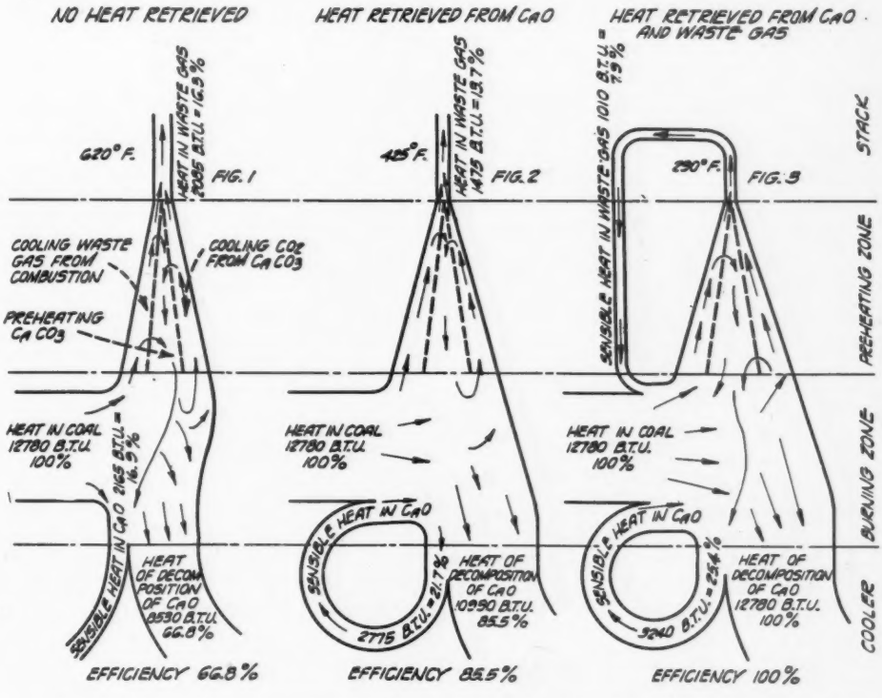


Chart 2—How the efficiency may be theoretically raised to 100% by recovering the heat lost in stack gases and burned lime

so much as 2% would be in the case of the previous loss, because part of this saved heat would be wasted on top of the lime kiln anyway and only a part, about 60%, would appear in the lime.

The loss due to incomplete combustion is fluctuating and varies inversely with the loss due to excess air, which is not separately charted, and is part of the stack loss. While some heat is generated during combustion of C to CO, this heat is of so low elevation that, after radiation and moisture reduce the temperature level still more, practically none is left for decomposition of calcium carbonate and so the entire amount may be considered as wasted.

A most serious loss is that due to radiation. There are three, or better four, distinct streams, one from the furnace or (in case of gas-producer equipped lime plant) from the producer, flues and furnace. The second is from the decomposition zone, the third from the preheating zone. There also is a fourth, from the cooler, not shown on the diagramatic Chart 1. The furnace and decomposition zone radiation losses can be reduced by insulation and practically all heat thus saved, being of high temperature elevation, becomes available at 100% efficiency for decomposition of limestone. The same would apply to the heat radiated from the cooler if the kiln is operated so that air enters the cooler and absorbs this saved heat and carries it into decomposition zone. If this principle is not used, then there is no gain, in fact inconvenience is created, with an insulated cooler. As to the loss of heat by radiation from the preheating zone, no harm is done, the reason being that more heat is available for preheating stone than is necessary.

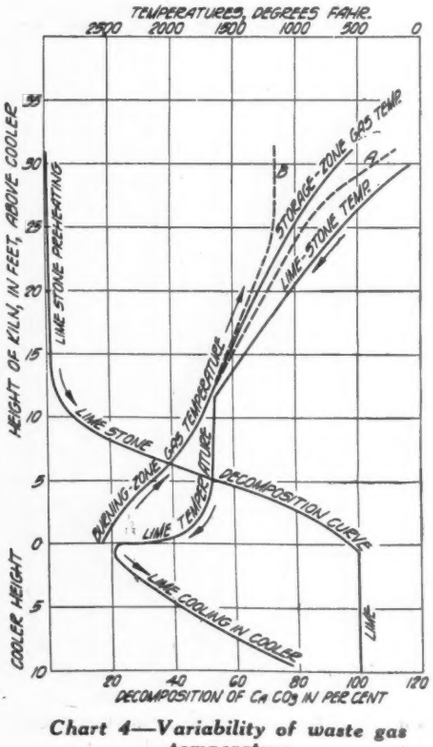


Chart 4—Variability of waste gas temperature

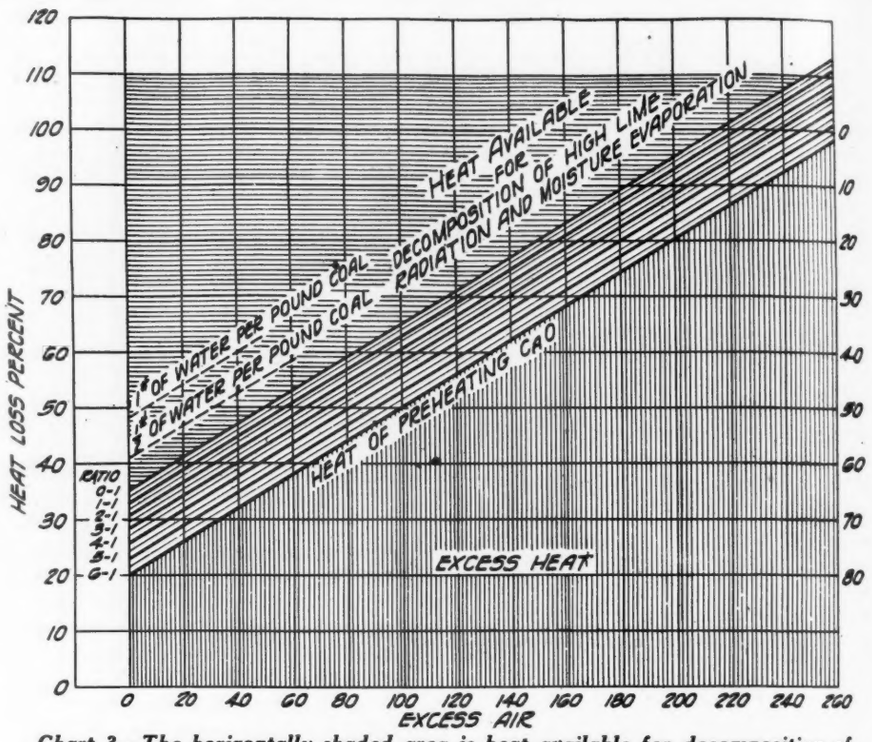


Chart 3—The horizontally shaded area is heat available for decomposition of lime. The diagonal area is heat needed for preheating the calcium oxide portion of the limestone and the vertically shaded area is excess heat wasted

A Theoretical Distribution of Heat

Compared with the actual lime kiln heat distribution, the theoretical distribution as shown in Chart 2 is quite different. Here the losses due to moisture, carbon in ash, incomplete combustion and radiation were not considered; only the heat actually given the kiln was taken into account. As a result, even when the sensible heat in the hot lime was not retrieved, the efficiency was double that which is the case in actual lime plants.

Chart 1 gives loss of heat in sensible form in the lime withdrawn at 7%. Peculiarly, if this heat is saved, the gain is much more than 7%. To explain this, it may be best to have recourse to Chart 2, Fig. 1 and Fig. 2. In the first, the sensible heat is wasted; in the second, it is all saved and as a result efficiency is increased from 66.8% to 85.5% and the lime-coal ratio goes up from 6.19 to 1 to 7.93 to 1. Not only all the heat retrieved appears in the lime, but, due to the greater amount of lime made, more stone passes through the kiln which has to be preheated and so the stack loss also is reduced.

There are few plants in the United States that successfully utilize sensible heat in the lime. It is true that in many cases lime is drawn cold but does not mean that the heat saved is efficiently utilized. With an improperly designed kiln, any attempts to save this heat will only make matters worse. Practical lime burners know this and so one often finds that not only the cooler is not used as an air preheater but great care is taken that no air enters it, by sealing it after every draw. Of all the plants the writer tested, there was only one in which the cooler acted as an air preheater in a satisfactory way and this very apparently was reflected in results of kiln performance, they being decidedly better without any other explanation for it.

Loss in Hot Waste Gases

The last loss is that due to sensible heat content of waste gases leaving kiln. Ordinarily, this loss fluctuates greatly but on the average it is about 30% as shown by Chart 1. Peculiarly, it is very difficult to reduce this loss beyond a certain point. Even in Chart 2 the theoretical kilns have a stack loss. No matter how high a kiln is, there will be a considerable stack loss even though the heat flow in the preheater is truly countercurrent, that is, cold stone coming down, hot gas going up—an ideal situation. There is no doubt that there is little, if any, advantage in making kilns higher than a certain definite dimension commensurate with kiln capacity based upon square feet of shaft area.

The reason for this situation is that the heat necessary for preheating as compared with that necessary for decomposition is relatively small. On the other hand, a very definite amount is available. In the case of a high calcium stone burning kiln, from 28% to as high as 50% is wasted in the stack, the actual amount depending upon the ratio of lime to coal and upon excessive air used. Chart 3 gives the results graphically. The horizontally shaded area is heat available for decomposition which, however, may be wasted by radiation or moisture evaporation. Diagonally shaded area is heat necessary for preheating of CaO portion of limestone. The heat necessary for preheating the CO_2 por-

tion of $CaCO_3$ does not need to be taken into consideration, owing to the exchange being what one would call regenerative. The heat necessary for preheating the CO_2 again becomes available after the CO_2 has been driven from the stone and is on the way up through the kiln. The vertically shaded area is excess heat wasted. It will be noted that at the ratio of 5 to 1 and zero excess air, the loss will be 23%, while under the more ordinary conditions of 40% excess air and ratio of 3 to 1, the loss is 40%, and the greater the excess air and lower the ratio, the greater the excess heat. This excess heat is not usable for any purpose because it is fluctuating in temperature elevation and the average elevation is too low for any practical use, such as waste heat steam generation or air preheating. Chart 4 shows the variability of waste gas temperature in different plants. It may be down to 200 deg. F. at one time of the day and up to 1200 deg. F. at another time, and this on the same kiln, with an average of about 700 deg. with high calcium, but considerably lower with magnesium, stone. The fluctuation is, of course, due to inability of limestone to take up more heat after it once becomes preheated, until such time as it reaches the zone where decomposition takes place.

How to Utilize Wasted Heat

How to reduce this wasted heat, how to utilize it practically, worried the writer considerably. While reduction was possible, the remaining and apparently unavoidably wasted amount was still large. After considerable study he formulated the following conclusion:

If the preheating zone contains sufficient heating area, the excess heat may be withdrawn from the kiln at the junction point of preheating and decomposition zones without thermally harming the kiln.

Any gas withdrawn from a kiln at this point will naturally be very hot, around 1600 deg. F., and will be very constant at this temperature. Due to this, it is ideal in utilization for waste heat steam generation purposes but its usefulness is even greater for preheating air for combustion, since all the heat exchanged into the preheating air, after it goes back into the kiln, becomes available for lime-making at 100% efficiency.

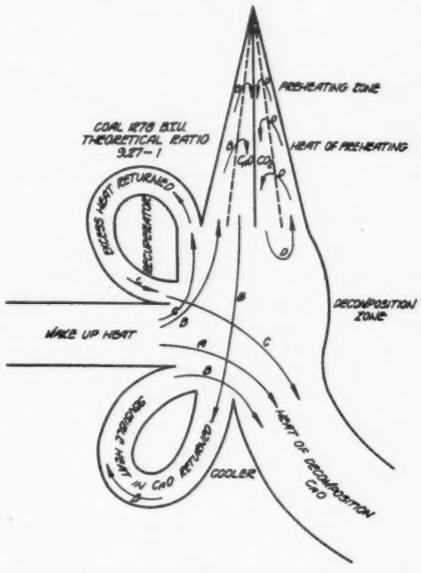


Chart 5—Heat flow in an ideal lime kiln

A patent application was made out not for the purpose of curtailing the use of the principle of employing otherwise wasted heat, but to insure proper application wherever a trial is made.

Chart 5 is a graphical exposition of the heat flow in an ideal lime kiln. It has, however, also a practical application, since it traces the flow of three main streams of heat through the kiln.

Stream "A" is the heat of high elevation in the hot gas entering the decomposition zone of lime kiln. Excepting that which is lost by radiation, all of it is used for decomposition and appears as latent heat in CaO leaving the cooler.

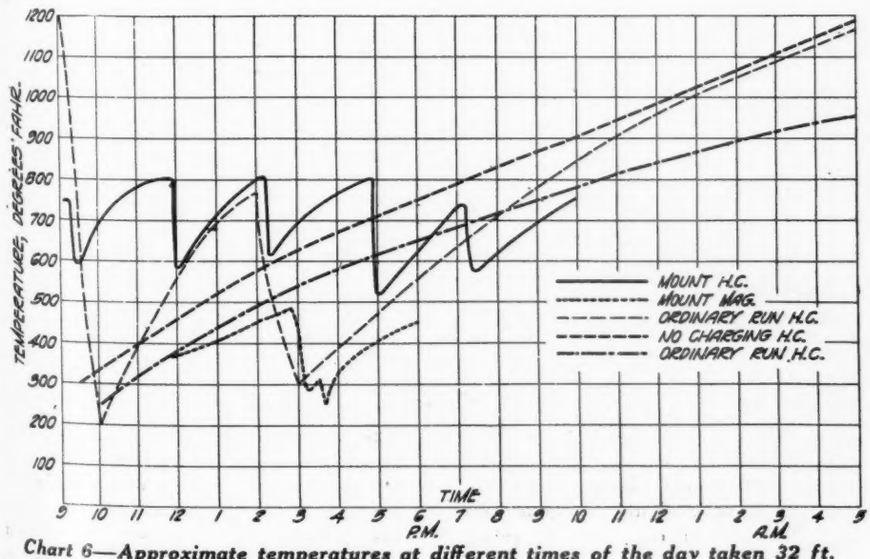


Chart 6—Approximate temperatures at different times of the day taken 32 ft. above the grate level at five different kilns running on high calcium and magnesian stone

Stream "B" enters the kiln with Stream "A" but, being of low elevation in temperature (lower than decomposition temperature of limestone) it passes through the decomposition zone unaffected. In the preheating zone, however, it transfers to the calcium oxide a portion of the down coming limestone and so passes through the decomposition zone and appears as sensible heat in the lime in the cooler. If the air passes through the cooler, the heat in stream "B" is absorbed, carried back into the decomposition zone, where it is superimposed upon Stream "A" and so appears as useful heat in the lime leaving the kiln.

Stream "C" is the heat ordinarily wasted on top of lime kilns. It is the same as Stream "B," but being in excess of that which can be absorbed by the limestone, it naturally becomes a waste, unless it is passed through a recuperator where part of the air for combustion is preheated. In that case Stream "C" enters the decomposition zone as sensible heat and superimposed upon Stream "A" becomes utilizable for limestone decomposition and appears as useful heat in the lime drawn from the cooler.

There is another stream "D" which is the heat carried from the decomposition zone by the escaping CO_2. This heat is equal in amount to the heat necessary to preheat CO_2 portion of the $CaCO_3$, consequently they balance and so on Chart 5 it is shown as a recirculating stream.

Applying the Principles Stated

It is only by utilizing the principles laid down by the above paragraphs and Chart 5 that maximum lime kiln efficiency becomes possible. Of course, 100% efficiency cannot even be approached, due to other losses that are not directly a part of the chemical-physical process of limestone decomposition. To minimize the other losses is an entirely separate problem.

Chart 6 gives approximate temperatures in a lime kiln of a height of about 32 ft. above grate level. Limestone decomposition curve shows that most of the kiln height is utilized for limestone preheating; that decomposition does not begin until about 12 ft. above the grate. At first, decomposition is fast, but gradually the rate reduces and the curve shape changes; ordinarily, in the hottest zone of the kiln, the least lime is made due to insulating layer of lime already formed. This relative speed of decomposition is probably far more at the beginning and less toward the end than is shown by the chart. It may be said that this is unfortunate for several reasons.

Gas temperature in the burning and storage zones is about 2500 deg. at the highest, then it drops, at first gradually, partially due to inability of the lime insulated limestone to take on the heat and partially due to the heating effect of the still unburned combustible gas. When the gas arrives higher in the zone the limestone can take up heat more rapidly and the temperature drops faster, but soon the temperature is so reduced that the

temperature difference between hot gas and limestone is slight, when the heat transfer rate becomes low. At 12 ft. the beginning of the decomposition zone, the temperature difference between heat taking and heat giving agents is the least.

The lime-limestone temperature curve from the initial decomposition point down increases, first slowly, then very rapidly, until almost the burning gas temperature is acquired, this being due to reduction in the cooling effect after less and less limestone becomes available for decomposition.

While below the 12-ft. level in the lime kiln, the temperatures are fairly constant, above this level they fluctuate continuously and depend upon the time since last charging of the kiln. The solid lines, however, represent about the average for the day. In addition, dotted lines for the gas were drawn. "A" is temperature after charging and "B" is approximate temperature before charging in the early morning.

Chart 6 study was necessary to determine the point at which the gas containing the excess heat may be withdrawn. Evidently the proper level is about the 12-ft. level. Now it is possible to design a kiln incorporating the various heat conserving items discussed.

Figure 7 is a schematic drawing of a lime kiln containing the features permitting attainment of the highest economy. The theoretical features are such that, as proven by Chart 5, no further increase in economy can well be attained, except by controlling losses for which the kiln itself is not responsible. In consequence, partly in a humorous and partly in a serious mood, the kiln was named "Ultimos."

In many lime plants steam is necessary and usually is generated under quite wasteful conditions. As is generally known, steam is made at about 360 deg. F. and lime at about 1600 deg. F. A boiler attached to the kiln as shown at "A" on the drawing would utilize otherwise wasted heat quite efficiently. Gas at 1600 deg. F. is quite satisfactory for steam generation. A boiler operated in this way, when equipped with damper control, feed water regulator and guarded by properly installed fuse plugs would require no fireman, so not only fuel but labor also would be saved.

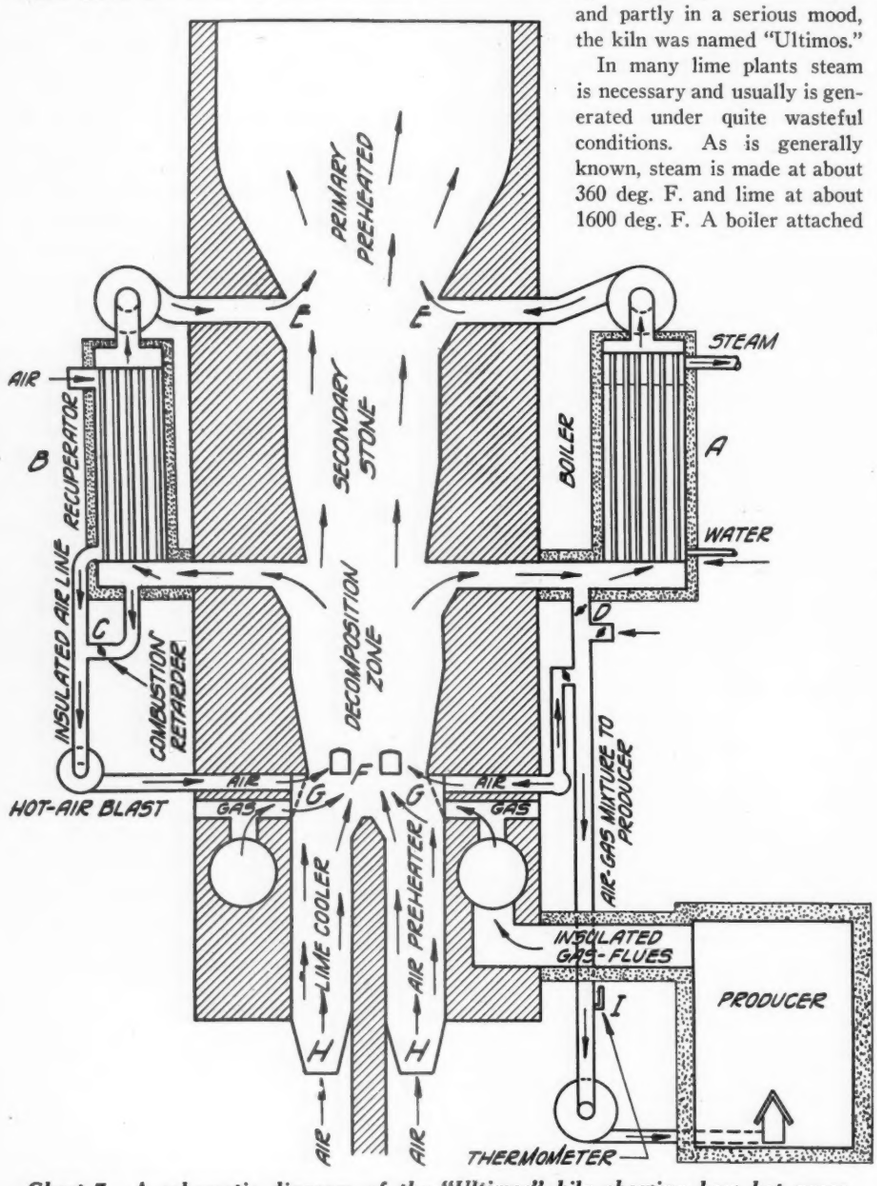


Chart 7—A schematic diagram of the "Ultimos" kiln showing how hot gases are drawn off above the decomposition zone and the heat in them recovered

"B" shows a recuperator preheating part of the air for combustion. The other part enters up through the cooler. A fan is necessary here as well as is the case with the boiler to draw the gas from the kiln and, of course, still another fan is needed to draw air through the recuperator and inject it into the kiln.

The cooled gas from either boiler or recuperator will be allowed to return to the kiln at "E." The reason is that more heat is needed in the primary than in the secondary stone preheater due to moisture in the stone. If, however, the gas is not returned to the kiln, fans are not needed and relatively short stacks on top of recuperator or boiler will draw gas from the kiln satisfactorily, since the resistance to gas flow in kiln due to the stone will be greater.

Preheated air, both from cooler and recuperator may make the burning zone in the kiln too hot. This can be overcome by holding back the time when gas and air come together by employing the construction shown at "G."

By drawing in, as at "F," the mixture of the air coming from the cooler with gas is assured. Without this drawing in, the air would slip up through the kiln center.

Recirculating Part of the Gas

It may be that, even though the burner is designed for retarded combustion, due to highly preheated air, the temperature may be too high at "F." In that case, the principle of recirculating part of the gas could be employed. At "C" a connection is shown between the hot gas and hot air ducts. Injection of inert gas will dilute the products of combustion and lower the rate of combustion and final temperature. This is practically the same as the Eldred process as improved by Dougherty. Recirculation of gas does no harm, provided the gas is taken off at the point shown and is guarded against loss of heat.

Using Excess Heat to Generate Steam

In gas producer operated plants, one of the greatest losses is caused by steam used in the producer. This steam is often used far in excess of what is necessary and since its heat-carrying capacity is very great, considerable heat passes from the decomposition zone over into the preheating zone and becomes unavailable for lime-making. To use CO_2 in waste gas from kiln top as an endothermic agent is far to be preferred, and it works very satisfactorily in actual practice, but even then the agent so employed is relatively cool and heat that otherwise would make lime has to be utilized in heating it up to that critical temperature of 1600 deg. F. If. however, the waste gas were to be withdrawn from the kiln as at "D" at the temperature of 1600 deg. F. mixed with air and blown into the producer, then the endothermic agent would be received fully preheated, it would cause no loss of heat, a large amount could safely be used without harm, and one of the greatest objections to gas producers in lime plant would be eliminated.

Chemical Reactions in the Gas Producer*

IT is of interest to know just how much information relative to the chemical reactions taking place in the gas producer can be obtained from the direct application of the laws of chemical equilibrium to the problem. With certain assumptions as to the manner of operation of the producer and the character of the fuel used, the following data can be obtained for any given ratio of steam to air in the incoming blast: (a) the temperature at which the producer will operate continuously, (b) the composition of the resulting producer gas, and (c) the thermal efficiency of the producer. The ratio of steam to air in the blast which will give maximum thermal efficiency can also be determined.

Incidental to the main purpose of the analysis, it is shown that although five chemical reactions are possible in the formation of producer gas, only three of these are independent from the standpoint of chemical equilibrium, and as far as the final results are concerned, only three need be considered. Choosing three convenient to the purpose, it is then possible to determine the amount of fuel burned according to each of these three reactions for any given ratio of steam to air in the blast.

In discussing the results of the present analysis, it must be considered that it is made under the following assumptions:

1—The producer gas contains no free oxygen, it having entirely disappeared according to the reaction, $C + O_2 = CO_2$, which is complete at all temperatures considered.

2—The fuel fired to the producer, which is operated continuously, is pure carbon.

3—The producer gas is in chemical equilibrium with the hot carbon at the temperature T (a constant temperature) and under atmospheric pressure.

4—Just enough steam is introduced with the air to maintain a constant temperature.

5—Radiation and conduction losses have been disregarded.

Under these assumptions it can be concluded that:

1—The nitrogen content of the producer gas increases with the temperature because less and less steam is being introduced with the air blast.

2—Above 2100 deg. F. the carbon dioxide and water practically disappear.

3—If operated at a temperature of 1750 deg. F. a maximum hydrogen content is obtained, but at higher temperatures the hydrogen content drops while the carbon monoxide content rises and remains practically constant.

4—At very low temperatures (1300 deg. F.) the water or steam goes through the producer practically as such and enters but slightly into reduction reactions.

5—The efficiency of the producer increases with the temperature at which it is operated up to 2000 deg. F. and then decreases because the amount of heat carried away by the hot gases leaving the producer increases with the temperature.

6—The amount of steam in the air blast required to maintain a given temperature is less the higher the temperature.

7—The maximum efficiency, under the assumptions made, approximately 0.4 lb. of steam per pound of carbon should be used.

8—Out of the five possible reactions

$$C + O_2 = CO_2 \quad (A)$$
$$C + H_2O = H_2 + CO \quad (B)$$
$$C + 2H_2O = 2H_2 + CO_2 \quad (C)$$
$$C + CO_2 = 2CO \quad (D)$$
$$C + H_2O = CO_2 + H_2 \quad (E)$$

it is only necessary to consider three principal reactions, of which one must be reaction A, but of which the other two may be chosen at will. If reactions A. C and D are taken to be the principal ones, it is shown that at low temperatures A is most effective, while at high temperature C plays a minor part, and A and D go together to form carbon monoxide.

*Abstract from *Industrial and Engineering Chemistry*, 18, 585 (1926).

Lime in Concrete Roads

THE use of lime in concrete roads has been made the subject of a bulletin just issued by the National Lime Association. Some states already specify lime in their highway concrete, and exhaustive field tests to determine the effect of such addition have recently been completed by other highway departments.

The data collected seem to show that lime makes the mix more uniform, holds the water-cement ratio more nearly constant, and improves the finish and riding qualities of the road, with the same or greater strength in the concrete.

The bulletin takes up in detail the tests which have been made and gives a considerable amount of information which will help the highway engineer in determining his policy with reference to the use of lime.

Recent Illinois Geological Survey Bulletins

THREE new bulletins have just been issued from the press by the State Geological Survey at Urbana, Ill.

The report, "Geology and Mineral Resources of the Joliet Quadrangle," by D. J. Fisher, is a comprehensive report on the geology of the northwestern part of Will county in the vicinity of Joliet. The report consists of 160 pages and two engraved maps, and is obtainable for 40 cents in postage or currency.

"The Glenwood Beds as a Horizon Marker at the Base of the Platteville Formation," by Arthur Bevan, has been published as Report of Investigations No. 9. It presents the important characteristics of the Glenwood beds as an aid in their identification in outcrops and in drill cuttings. The formation is described briefly. Its value as a stratigraphic key is emphasized and the geologic conditions under which it was formed are discussed.

"A Preliminary Report on the Economic Mineral Resources of Calhoun County," by J. E. Lamar, has been published as Report of Investigations No. 8. The report consists of 21 pages, and deals with the mineral deposits of the county, which include limestone, shale, clay, sand and coal. It also includes a brief discussion of factors to be considered in opening a quarry and in general quarry practice. The possibility of commercial deposits of glass and common sand, phosphates and oil is also discussed. The report may be obtained for 20 cents in postage or currency.

The above publications may be secured at the prices designated by addressing the chief, State Geological Survey, Urbana, Ill.

Asbestos Production in South Africa

THE Union of South Africa is reported to be the principal world producer of the variety of asbestos known as crocidolite.

A steady output has been maintained for many years, and extensive supplies are available should the price warrant the opening of deposits already located. The exploitation of the recently discovered amosite variety seems promising, and this fiber is found only in the Union and in large amounts.

In the case of chrysotile, the Union producers have to compete with those of Southern Rhodesia. These two countries appear to have the only developed sources of supply within the southern hemisphere. The chrysotile resources of the Barberton district have the advantages of an exceptionally high percentage of recovery, low mining costs and proximity to railway line and shipping port.

Use of Wire Saw in Slate Quarrying

A GREAT need in the slate industry is the elimination of quarry waste which now varies from nine-tenths to fifteen-sixteenths of gross production. Present methods of cutting, wedging, and blasting slate are responsible for much of the waste. If the wire saw could be operated successfully a great saving could be accomplished. The Bureau of Mines is preparing to run a series of tests with the wire saw in Pennsylvania slate quarries. The work will be conducted under the direction of Dr. Oliver Bowles, superintendent of the New Brunswick, N. J., experiment station of the bureau.

Proposed Purchase Specifications for Concrete Aggregate

[Editorial Note—The following tentative specifications for purchasing concrete aggregate were presented at the February meeting of the American Concrete Institute. An abstract was published at that time in ROCK PRODUCTS. The full text is now presented. These purchase specifications will not be made standard until the end of a year, during which time producers and others interested have ample time to offer criticism and to make objection to any portion that seems unfair or impracticable.]

Materials Covered

THESE specifications cover the quality and size of aggregates proposed for use in the construction of portland cement concrete in cases where strength is the quality of primary importance. Where it is essential that the concrete possess additional characteristics, such as fire resistance, resistance to sea water action, etc., such additional requirements for the aggregates as may be found necessary should be inserted in these specifications.

The committee is at work on this problem and will furnish suggested test requirements covering the physical characteristics of aggregates for special purposes as addenda to these specifications as soon as possible.

Fine Aggregate

General Characteristics

Fine aggregate shall consist of sand or other approved inert materials with similar characteristics, or a combination thereof, having clean, hard, strong, durable, uncoated grains and free from injurious amounts of dust, lumps, soft or flaky particles, shale, alkali, organic matter, loam or other deleterious substances.

Grading

The fine aggregate shall be uniformly graded from coarse to fine and, when tested by means of laboratory sieves, shall meet the following requirements:

Passing ⅜-in. sieve	100%
Passing No. 4 sieve, not less than	....% (a)
Passing No. ..... sieve.....to.....	....% (b)
Passing No. 50 sieve.....to.....	....% (c)
Passing No. 100 sieve.....to.....	....% (d)

The grading requirements will vary with the type of work and the characteristics of materials available. Wherever practical, the following values should be inserted in their proper places in the specification for grading:

(a) Some value between 85 and 95%.

(b) Values depending upon the materials available which will insure reasonable gradation of that portion of the product between the No. 4 and No. 50 mesh sieve.

(c) 5 to 30%.

(d) 0 to 5%.

Clay and Silt

The weight of clay and silt removed by decantation shall not be more than .....%.

Wherever practical, this value should not exceed 3%.

Organic Impurities

All fine aggregate shall be free from injurious organic impurities. Aggregate subjected to the color test for organic impurities and producing a color darker than the standard color shall be rejected unless subsequent mortar strength or concrete strength tests indicate them to be suitable for use.

Mortar Strength

Fine aggregates when subjected to the mortar strength test shall have a tensile or compressive strength at the age of 7 and 28 days of not less than 100% of that developed by mortar of the same proportions and water-cement ratio, made of the same cement and standard Ottawa sand.

Concrete Strength

Fine aggregates passing the ⅜-in. sieve but otherwise failing to meet the requirement herein provided, or in which there is doubt as to the presence of injurious amounts of deleterious substances not specifically limited, may be used provided the proportions can be so adjusted that, when tested in combination with the coarse aggregate to be used on the work, the cross-bending or crushing strength of the concrete at the end of 7 and 28 days will be at least equal to that of concrete of the same consistency made with the same water-cement ratio, the same cement and aggregates meeting all the requirements of the specifications and mixed in proportions suitable for the class of concrete under consideration.

This provision is only for the purpose of establishing whether or not it is possible to make satisfactory concrete with the fine aggregate in question. The proportions to be used on the work must be elsewhere specified.

Coarse Aggregate

General Characteristics

Coarse aggregate shall consist of crushed stone, gravel, air-cooled blast-furnace slag, or other approved inert materials of similar characteristics, or combination thereof, having clean, hard, strong, durable, uncoated particles, free from injurious amounts of soft, friable, thin, elongated or laminated pieces, alkali, organic or other deleterious matter.

Limits defining the amounts of the various injurious substances enumerated above which may be permitted in the coarse aggregate should be inserted, depending upon the characteristics of the local materials available. The committee suggests that, in the case of blast-furnace slag, a weight per cubic foot in the size or sizes required not less than 65 pounds be specified. The committee expects to furnish as addenda to these specifications suggested limits defining the amount of allowable injurious substances for the various materials listed above.

Grading

Coarse aggregate shall be uniformly graded between the limits specified and shall meet the following requirements:

Passing (maximum size) inch sieve	95 to 100%
Passing (intermediate size) inch sieve	....to .....%
Passing No. 4 sieve	0 to 10%
Passing No. 8 sieve	0 to 5%

The grading requirements will vary with the type of work and the characteristics of the available materials. Appropriate values should be inserted in the specification for grading of coarse aggregate which will insure the proper maximum size as well as a reasonably uniform gradation of material from the maximum size to the No. 4 sieve size.

Soundness Test

Coarse aggregate shall pass the test for soundness, except that aggregates which fail in the accelerated sodium sulphate soundness test may be used provided they will pass a satisfactory freezing and thawing test made in accordance with methods hereinafter specified.

The committee is at work upon the problem of formulating a satisfactory specification covering resistance to repeated frost action, and hopes to present suggested test limits within the near future.

Concrete Strength

Coarse aggregate conforming to the requirements for maximum and minimum size, but otherwise failing to meet the requirements of these specifications, or in which there is doubt as to the presence of injurious amounts of deleterious substances not specifically limited, may be used provided the proportions can be so adjusted that, when tested with the fine aggregate to be used in the work, the cross-bending or crushing strength of the concrete at the end of 7 and 28 days will be at least equal to that of concrete of the same consistency made with the same water-cement ratio, the same cement and aggregates meeting all the requirements of these specifications and mixed in proportions suitable for the class of concrete under consideration.

This provision is only for the purpose of establishing whether or not it is possible to make satisfactory concrete with the coarse aggregate in question. The proportions to be used on the work must be elsewhere specified.

Methods of Sampling

Methods of sampling fine aggregate shall be in accordance with A. S. T. M. Standard Methods of Sampling Stone, Slag, Gravel, Sand and Stone Block for Use as Highway Materials, Serial Designation No. D75-22.

Methods of Testing

Sieve analyses shall be made in accordance

with A. S. T. M. Standard Methods of Test for Sieve Analysis of Aggregates for Concrete, Serial Designation No. C41-24.

The decantation test shall be made in accordance with the A. S. T. M. Tentative Method of Decantation for Sand and Other Fine Aggregates, Serial Designation No. D136-22T.

The test for organic impurities shall be made in accordance with the A. S. T. M. Standard Methods of Test for Organic Impurities in Sand for Concrete, Serial Designation No. C40-22.

The test for mortar strength shall be made in accordance with the methods prescribed in A. S. T. M. Standard Specifications and Tests for Portland Cement, Serial Designation No. C9-21.

Tests for concrete strength shall be made in accordance with the A. S. T. M. Standard Methods of Making Compression Tests of Concrete, Serial Designation No. C39-25.

The sodium sulphate test for soundness shall be made in accordance with the method of test given on page 8 of U. S. Department of Agriculture Bulletin No. 1216.

The tests for alternate freezing and thawing shall be made in accordance with the standard methods of making freezing and thawing tests of drain tile in Section (C) of A. S. T. M. Standard Specifications for Drain Tile, Serial Designation No. C4-24.

This report has been submitted to letter ballot of the committee which consists of eleven (11) members, of whom seven (7) have voted affirmatively, one (1) negative, and three (3) have refrained from voting.

R. W. CRUM,
Chairman Aggregate Committee, American Concrete Institute.

Abstracts of Foreign Literature on Rock Products

A LONG and comprehensive article has been published in *Zeitschrift fur angewandte Chemie*, 1926, volume 39, pages 175 to 186 on the manufacture of aluminous cement and its properties.

The article describes the use of a bauxite, which is obtained in the Vogel mountains of Germany, as a raw material in the manufacturing process. The cement possesses a composition which falls well within the range of those cements which are included in the Gibbs triangular system.

Various tests were carried out on these cements. Microscopical examinations showed that they consist of an amorphous ground mass which is intermixed with crystals of melilith. Setting and hardening experiments made on these cements showed that the effects observed with regular portland cements are duplicated in this case. It was seen that the amorphous matter in the cement was first attacked by the water and converted into a mass of interlocking crystals. It has been held that this probably accounts for the quick-setting properties of the cement. Thereafter the lime and alumina pass into solution, and then colloidal alumina and silica are deposited in a reactive "gel" form. This is then converted into calcium silicates, aluminates or aluminosilicates, thus causing the hardening of the cement.

A range of products can be obtained in which a gradual transition from aluminous to portland cement occurs. When the lime content of the cement is high, it appears that it sets and hardens rapidly but the strength of the product is low. When a large portion of the alumina in aluminous cements is replaced by ferric oxide, the strength is reduced, since ferrite has no binding properties. The aluminous cements stand up well against the action of acids, for example a 10% solution of potassium bisulphate, unless the iron content of the cement is high. They are also resistant to magnesium sulphate solutions.

Portland Cement from Gypsum

Gypsum or anhyrous calcium sulphate is mixed with clay, sand and a small proportion of coal, and the mixture is then so finely ground that, at the most, 8% of the residue is left on a 4900 mesh per square centimeter sieve. The mixture is then slightly moistened and then heated at a temperature of 1400 to 1500 deg. C. in a rotary kiln. A portland cement of good properties is obtained in this fashion, and at the same time the sulphur in the gypsum is converted into sulphur dioxide and eventually into sulphuric acid. For further details see French Patent No. 596,423.

Magnesia Cement

An aqueous suspension of crystalline magnesium chloride or an aqueous solution of the oxychloride is mixed with magnesia in the desired proportions, and the resulting powder is heated to a temperature of approximately 250 degrees C. The magnesium chloride solution and magesia may be mixed by simultaneous spraying and the mixture dried by hot gas. Bonded magnesia cements or materials prepared from magnesia cement may be regenerated by heating to somewhat above 250 deg. C. (German Patent No. 421987).

Setting of Hydraulic Cements

The explanation which has been advanced by LaChatelier for the setting of cements is considered to be insufficient in an article which was published in *Comptes rendues*, volume 182, pages 128-9.

It is suggested in that article that the setting of the cement takes place in three separate stages. In the first place there is dissolution, during which the liquid is progressively saturated with the different soluble substances. Then there is the "colloidation" process, during which the products of the chemical reaction are obtained in the colloidal state, this status corresponding with the initial set. In the third place there is the process of crystallization, in which the gels are transformed into aggregates of large crystals on account of the greater solubility of the smaller crystals.

This theory was verified by shaking portland cement with water and analyzing the liquid from time to time, and also analyzing the crystals (calcium hydroxide) which formed gradually on the walls of the containing vessel following an initial separation of the flocculent material.

Setting of Sorrel Cement

The setting of magnesia cement (Sorrel cement) is discussed in an article that is also concerned with the manufacture of "xylolith" from sawdust and magnesia cement, printed in *Hauptversammlungen Ver. Deutsche Steinholzfabrikation*, 2.5, 25.

The setting of the cement is usually ascribed to the formation of magnesium oxychloride. The author shows that the amount of magnesium chloride used in only a fraction of that required to form the oxychloride, while the setting will also take place with salts other than chlorides or magnesium salts. A determination of the viscosity of suspensions of finely divided magnesium oxide in various setting agents and water shows that the setting of the cement is due to the formation of magnesium hydroxide in a colloidal form, and not of magnesium oxychloride.

Large Size Natural Grindstones Still in Demand

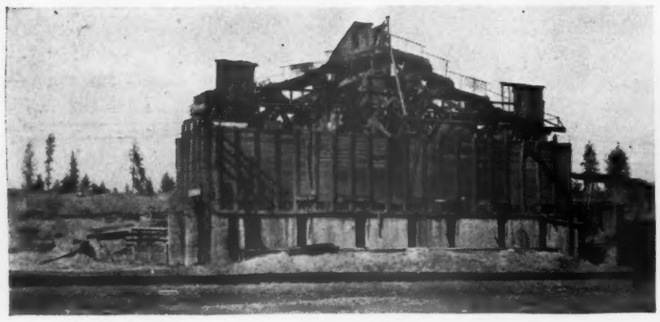
ARTIFICIAL grindstones are reducing the market for the natural product, though the natural stone still retains its supremacy in the larger sizes. The competition has had the effect, however, of bringing about a more careful selection of stone for this purpose, with closer adherence to the standard requirements for an ideal grinding surface.

The sandstone for this purpose should be of uniform texture throughout, and should be so hard as to resist undue wearing away, but soft enough so that it will not glaze or become overheated.

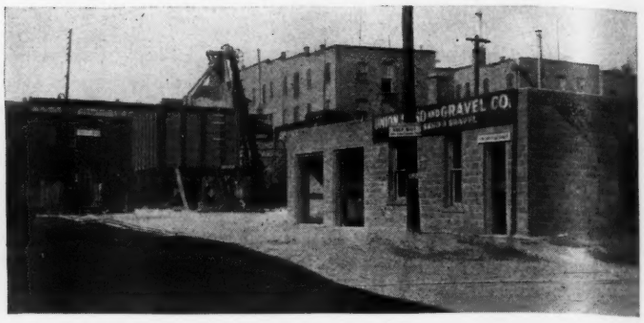
The stone should also be able to withstand weathering and the application of water without cracking or chipping.

The size and shape of the silica grains are important, and vary with the particular purpose for which the stone is to be used, while the nature of the bonding material must also be taken into consideration in determining the suitability of a deposit for the purpose of manufacturing grindstones.

Grindstones are not rock products in the usual way the expression is used. They are, however, a by-product of some plants which produce silica sand in the middle western states.



Washing plant with two sets of screens



Spokane office and bunker for truck loading

Successful Gravity Screening

Union Sand and Gravel Co., Spokane, Wash., Works Out an Efficient System

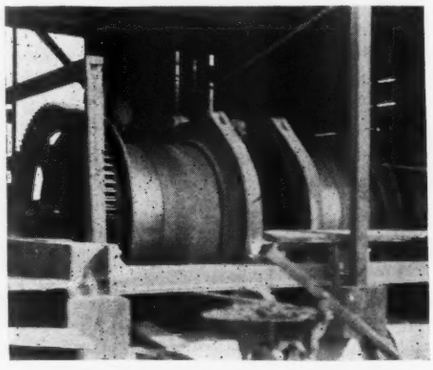
THE plant of the Union Sand and Gravel Co. of Spokane, Wash., is at Fort Wright, two miles west of the city. It is not a large plant, nor a new one, but it is interesting because of the very successful use of gravity screens for sizing the material.

The deposit is high up on the banks of the Spokane river and appears to be an old river terrace. The depth that is worked is about 60 ft. No stripping is needed, except enough to remove the grass and roots from the surface, as these bother the screens badly when they are left in. The deposit runs 65% in gravel and 35% in sand.

A Bagley scraper bucket is used to excavate the pit material. It is operated through a Denver Engineering Works double-drum hoist with a 114-hp. General Electric motor. The bucket is of 1¾-yd. capacity and the run is about 500 ft. A good feature of this installation is the way the sheave is suspended between two poles, which enables the path of the bucket to be widened without changing the poles.

The bucket discharges over a bar grizzly, with 2-in. spaces. The oversize goes to a 12x18-in. J. I. Case jaw crusher which is driven by a 20-hp. General Electric motor. There are several crushers of this make in this part of the country. The undersize falls into a chute into which the crusher discharge passes and both together go to an 18-in. Link-Belt conveyor of 300-ft. centers.

This discharges to a second conveyor of the same type, which is also 300 ft. long and which delivers to the washing plant. The discharge falls on a table, where it joins a stream of water from a Byron-Jackson three-stage centrifugal pump, which is situated at the river, 186 ft. below the plant and 1200 ft. away.



Double-drum hoist of a type developed for mine hoisting

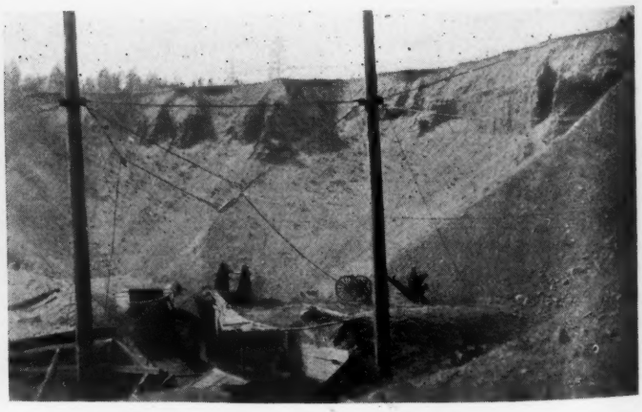
The table over which the water flows is about 6 ft. wide and 8 ft. long and is set at 1½-in. to the foot. The flow strikes against a 1½-in. screen, set at 45 deg., at the end of the table and the oversize goes to a bin. The undersize goes to a 1-in. screen over a similar table and the undersize of this screen to a sand screen with ¼-in. meshes. All the screens are of wire cloth with comparatively light wires. The screens are easily changed to vary the product or to make special material, such as roofing gravel.

The oversize of the sand screen is rescreened over a "Ton-Cap" screen, which is set at a flatter angle. The oversize, which is ⅝-in. to ½-in., is sold as stucco aggregate for pebble dash work. The undersize is sent to waste, since there is an excess of the smaller sizes of pebbles. At times this excess is sold for road dressing, but the market is not sufficient to take it all.

The undersize of the ¼-in. screen goes to two sand tanks in series. These are simple square boxes with holes at the side for discharge. A board placed over each hole regulates the flow. The second box takes the overflow from the first, making two grades of sand, a concrete sand and a brick sand. The overflow of the fine sand tank goes to waste.

The gravity screens do excellent work, as good as is ordinarily done by rotary screens. This is unusual, so the screening

Loaded bucket being hauled in with 1 3/4 yd. of material from terrace above Spokane river



Sheave of dragline suspended between poles, making it easy to widen path of bucket

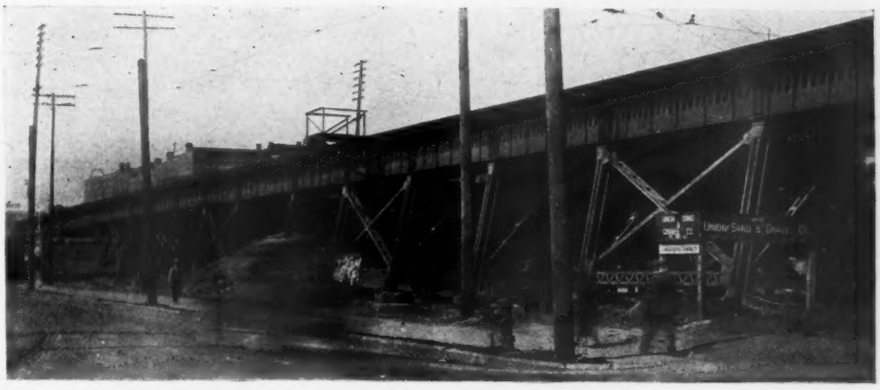
Grizzly, with crusher below, start of first conveyor, and log cabin motor house in background

Belt conveyor from pit to plant is in two flights with hopper feeding from one to the other

method was studied somewhat to find out the reasons for such good work. One reason is that the flow of water and solids is uniform so that the screens are neither crowded nor underfed. Another is that the flow strikes the screens rather gently, so that there is no splashing which would carry sand into the gravel. And a third reason must be found in the nature of the material, which does not blind the screens very much. They will run for a long time without cleaning. The gentle flow probably has something to do with keeping the screens clear, as the grains would be driven into the meshes by a stronger flow.

The concrete sand is rather coarser than is usual and makes a strong concrete mortar. Under the glass the grains appear to be mainly of quartzite and flint and other siliceous rocks. The pebbles have the same composition.

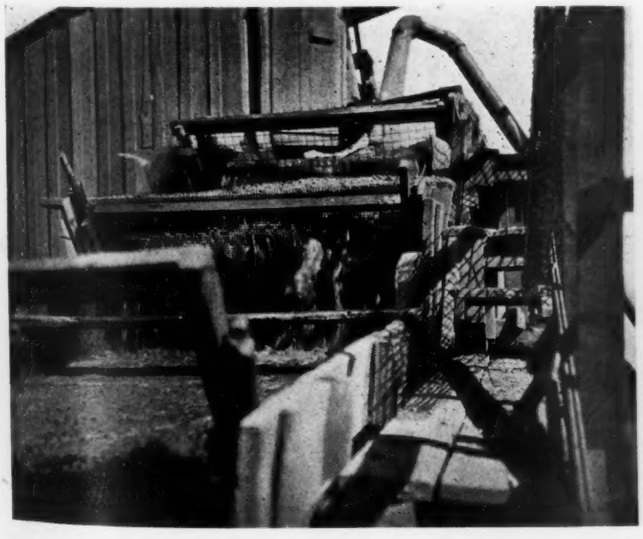
All the product is shipped over the Great Northern Railway and most of it goes to the yards which the company maintains at Spokane. At these yards there are six bunkers under a steel trestle, and hopper-bottom cars are used which dump directly into the bunkers. These bunkers are used for concrete sand and the three sizes of gravel that are ordinarily made.



Six bunkers under steel trestle, holding about 200 tons each

Another bunker which has just been built is used for fine sand, for roofing gravel and stucco aggregate or finishing aggregate. This has a 14-in. bucket and belt elevator leading from a hopper into which the sand or gravel is dumped from trucks. A movable chute at the top sends the elevator discharge to any bin desired.

Lawson Moore is manager of the company and S. E. Lovejoy is plant superintendent. The office of the company is at 517 North Lincoln street, Spokane.



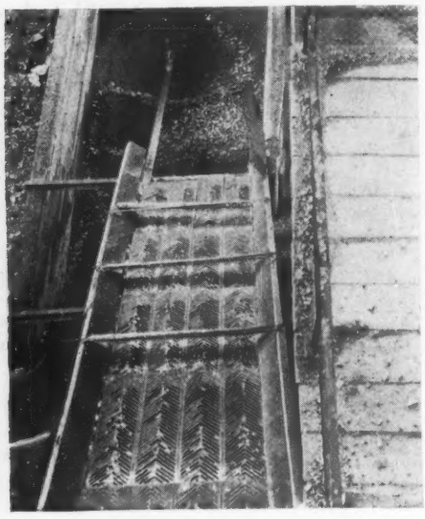
Gravity screens and flow tables, the oversize being rescreened, in the case of fine sizes, on a screen below the table

Where the conveyors join, the discharge of the first falls into a hopper with a gate to control the feed to second conveyor

Hints and Helps for Superintendents

A Special Screen for Removing Dirt from Crushed Stone

AT the crushed stone plant of the Zenith Limestone Co. of Tulsa, Okla., a screen is used to separate the fines and dirt from the commercial sizes coarser than ¼-in. diameter. The quarry is worked without stripping so some dirt gets in from the overburden. And while the lower part of the ledge is of very solid and unstratified limestone the upper few feet of the ledge has been partly weathered so that some dirt gets in from that source. It is considered cheaper to work the quarry without removing the overburden and to throw away the small quantity of limestone fines that goes through the screen with the dirt.



The screen in place between a crusher and conveyor belt

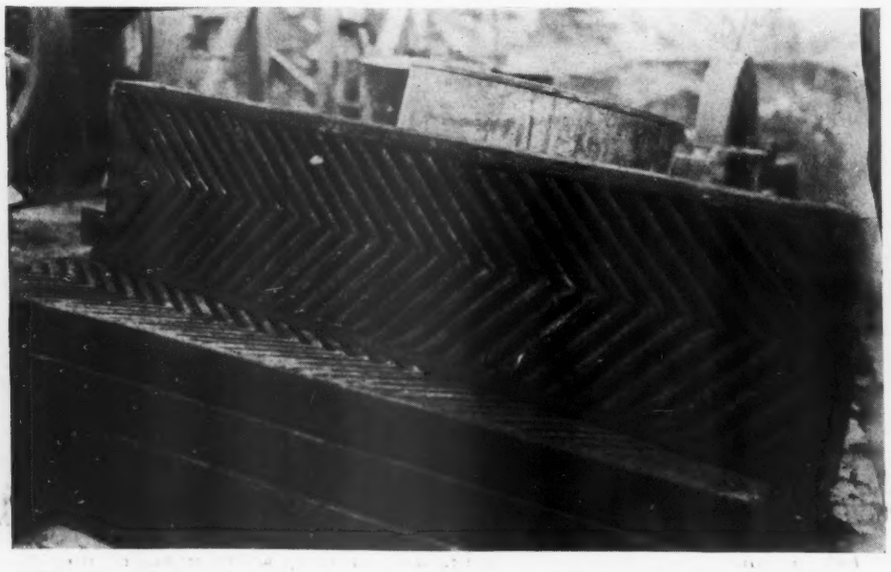
The screen used is of the gravity type. In fact no other type of screen is used in this plant. The ground is very steep where the crushing plant is built and the stone in flowing from one crusher to another passes over grizzlies which remove the stone already crushed to size. Wherever such a screen can be introduced one of the specially designed screens for taking out dirt is put in and all the product passes over the large screen shown in one of the pictures before it goes to the conveyor that takes it to the final sizing screens.

The screen used was designed by R. D. Long, the manager of the plant, and it has been patented by him. It is made in cast iron units about 3 ft. 6 in. long and 12 in. wide. Each unit contains a series of herringbone slots, and these are set with the point away from the flow as shown in the picture of the screen as it is in use.

The slots are larger on the under side than on top and this is fairly efficient in preventing blinding. The picture of the screen was taken just after the plant had shut down for the day and in the condition it was left after the day's work. It will be noted that there is very little blinding of the slots. Pieces which stick in the slots are usually broken off and hammered through at once by the coarser stone passing over them.

The use of a gravity screen for cleaning stone is not new but this particular type of screen would seem to have certain definite advantages over the wire and perforated metal screens ordinarily employed for this purpose. For one thing, these heavy cast-iron screens last a long time. Those in use more than a year show scarcely any wear.

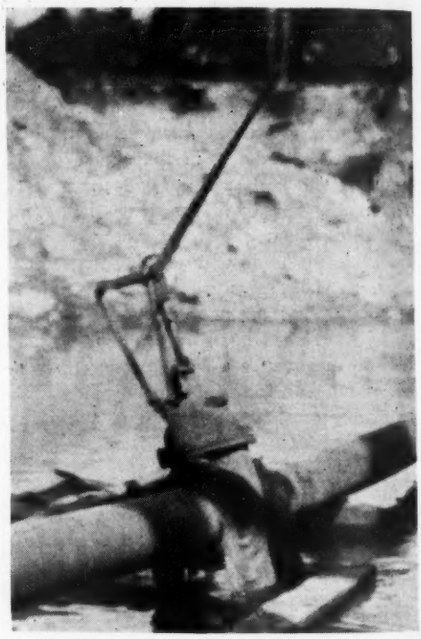
This ought to make a good screen to put in the bottom of chutes through which stone flows as it is loaded into cars from a bin.



The herringbone slats are wider on the bottom of the screen as is shown here

Gate Valve in Pipe Line Helps to Prime Dredge Pump

IN priming the centrifugal pump of a suction dredge the suction pipe is raised in the usual method and water pumped in from a smaller pump, or run in from a tank, until the pump is full.



Lever operated gate valve used on discharge line to help prime the pump

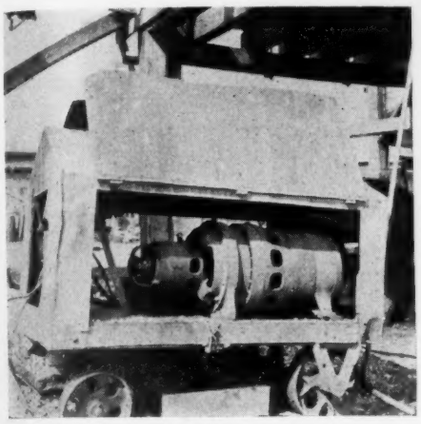
The cut shows a discharge line with a valve which is used while priming. The valve is of the "quick acting" pattern which opens and closes with a lever instead of a screw. When the pump is to be primed the suction pipe is raised so that its mouth is above the level of the pump and the gate valve is closed. It requires a very short time for the priming pump to fill the big pump, the suction, and the short piece of line between the pump and the valve. As soon as water runs out of the suction the pump is ready to start; the suction is dropped and the valve jerked open by a man who stands on the pontoon near the valve. This means a saving of several minutes in lost time when the pump has to be stopped.

The valve is always either fully opened

or fully closed so the wear on the gate is small. The picture was taken from the dredge of the Hattiesburg Sand and Gravel Co., at Hattiesburg, Miss.

A Simple Electric Welding Outfit

A WELDING outfit is now an indispensable part of all rock products plants, and a portable welding outfit is usually essential as so many repairs have to be made at some distance from the machine shops.

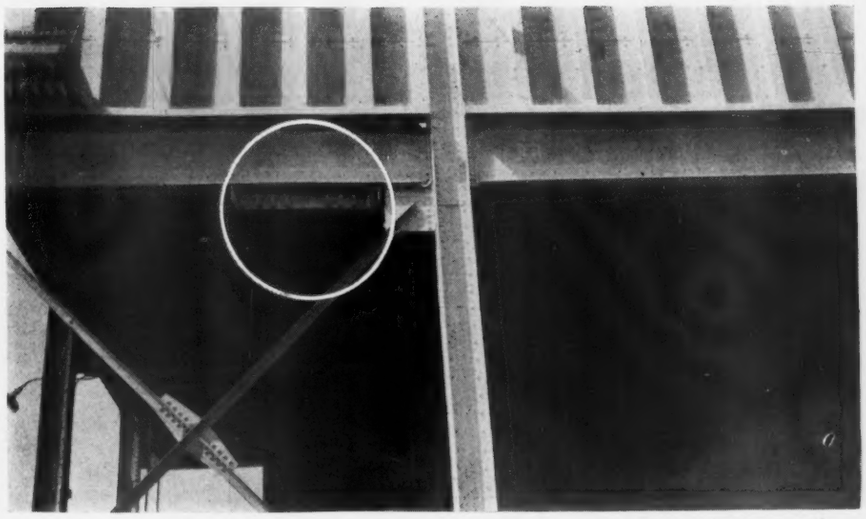


Motor generator set mounted on truck makes a good portable welding outfit

The cut shows a small electric welding machine which is truck mounted so that it can be easily moved by hand to wherever it is needed. The motor-generator set was purchased of course but the truck was "home made." It is used on the wharf and yard of the Mobile Gulf and Navigation Co. at Mobile, Ala.

Lights Show Full Bins

A DEVICE has been worked out at the Krause, Ill., plant of the Columbia Quarry Co., St. Louis, Mo., so that the superintendent sitting in his office can tell which of the plant bins are full. This is accomplished by a row of colored electric-light bulbs on the side of the bins facing the office. By pushing a button at the top of the bins, the signal light for that bin is made to show. Of course, the lights might have been placed in the office as well as on the bins.



A system of colored lights used to indicate full bins

Clarence Klaus is superintendent of the plant and C. E. Glasson chief engineer in charge of construction.

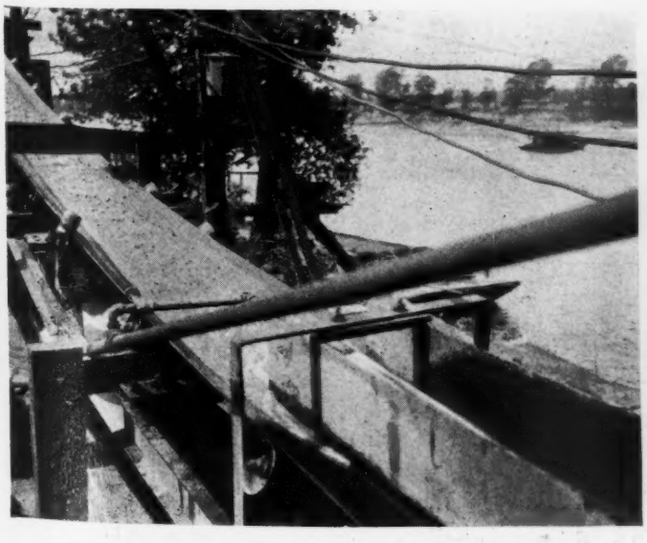
Removing Water from a Conveyor Belt

THE discharge of sand from any of the regular forms of automatic settling boxes may be carried on a conveyor belt if the belt runs fast enough and has not too great an inclination. But there is always an excess of water to bother at the discharge point and at times a settling box may discharge more than the usual amount of sand and water so that the belt is flooded and the water runs over the sides. To prevent this the box shown in the illustration was devised and put in use at one of the plants of the Stewart Sand Co., Kansas City, Mo.

The box is placed so that it just clears the load on the belt. The height may be adjusted by shimming between the frame and the bolts shown in the pictures. Whenever there is an unusual amount of water on the belt it flows back into this box and out of a pipe which is attached to one side.

A little sand goes back with the water and to prevent this sand from accumulating in the pipe the jet shown in the picture has been added. This jet also helps the water to flow to the outlet pipe. The loss of sand with the excess water has been found to be about 3 yd. per day. As the production of the plant is from 1500 to 2000 yd. per day the loss is of no moment.

The belt has an inclination of about 10 deg. from the horizontal. It has to be run at 500 ft. per minute to keep the water from flowing back over the end of the belt.



The water box in its place above the belt and the adjusting support

Close-up of box and the spray which makes a current to the discharge

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

(These are the most recent quotations available at this printing. Revisions, corrections and supplemental information will be welcomed by the editor.)

Stock	Date	Par	Price bid	Price asked	Dividend rate
Alpha Portland Cement Co. (common)[2] new stock	June 6	100	42	44	1½% quar. Apr. 3
Alpha Portland Cement Co. (preferred)[2]	June 8	100	115	.....	1¾% quar. Mar. 1
Arundel Corporation (sand and gravel—new stock)	June 4	No par	33	34½	30c quar., Apr. 1
Atlas Portland Cement Co. (common)[3]	June 7	No par	45	47½	50c quar. Mar. 1
Atlas Portland Cement Co. (preferred)	.....	100	.....	.....	2% quar. Oct. 1
Atlas Portland Cement Co. (preferred)[3]	June 8	33⅓	44	47	2% quar. Apr. 1
Bessemer Limestone and Cement Co. (common)[4]	June 4	100	135	142	1½% quar. Jan. 1, 4% ex. Jan. 1
Bessemer Limestone and Cement Co. (preferred)[4]	June 4	100	107	109	1¾% quar. Jan. 1
Bessemer Limestone and Cement Co. (convertible 8% notes)[4]	June 4	.....	120	130	8% annual
Boston Sand and Gravel Co. (common)[10]	June 4	100	60	75	2% quar. July 1
Boston Sand and Gravel Co. (preferred)[10]	Apr. 8	.....	.....	75	1¾% quar. Oct. 1
Boston Sand and Gravel Co. (1st preferred)[10]	Apr. 8	.....	.....	85	2% quar. Oct. 1
Canada Cement Co., Ltd. (common)	June 9	100	102	104	1½% quar. Apr. 16
Canada Cement Co., Ltd. (preferred)[11]	June 4	100	113¼	114	1¾% quar. May 15
Canada Cement Co., Ltd. (1st 6's, 1929)[11]	June 4	.....	102	103	3% semi-annual A&O
Canada Crushed Stone Corp., Ltd. (6½s, 1944)[11]	June 4	100	92	96	
Charles Warner Co. (lime, crushed stone, sand and gravel)	June 5	No par	23	24½	50c quar. Apr. 12
Charles Warner Co. (preferred)	June 5	100	101	103	1¾% quar. Apr. 22
Charles Warner Co. (lime, crushed stone, sand and gravel) 7s, 1929[18]	June 4	100	103	105	
Cleveland Stone Co.	June 9	.....	166	167½	1½% quar., June 1, 1% ex. June 1
Connecticut Quarries Co. (1st Mortgage 7% bonds)[17]	June 4	100	104	.....	
Consolidated Cement Corp. (1st Mort., 6½s, series A)[24]	June 10	.....	95	98½	
Consolidated Cement Corp. (5 yr. 6½% gold notes)[24]	June 10	100	99	100	
Consumers Rock and Gravel Co. (1st Mort. 7s)[18]	June 4	100	99	101	
Dexter Portland Cement Co. (6% serial bonds, 1935)[23]	June 5	.....	99	101	
Dolese and Shepard Co. (crushed stone)[7]	June 10	50	91	.....	$1.50 quar. July 1, $1 ex. July 1
Egyptian Portland Cement Co. (7% pfd. with com. stock purchase warrants)[21]	May 24	99	101	.....	
Egyptian Portland Cement Co. (common)[21]	May 24	18	20	.....	
Giant Portland Cement Co. (common)[2]	June 7	50	32	38	
Giant Portland Cement Co. (preferred)[25]	June 7	50	44	48	3½% s.-a. June 15
Ideal Cement Co. (common)	June 9	No par	70	72	$1 quar. Jan. 2. 50c ex. Dec. 27
Ideal Cement Co. (preferred)[6]	June 6	100	107	109	1¾% quar. Jan. 2
International Cement Corporation (common)	June 9	No par	55	56	$1 quar. June 30
International Cement Corporation (preferred)[2]	June 9	100	104	104	1¾% quar. June 30
International Portland Cement Co., Ltd. (preferred)	Mar. 1	.....	30	45	
Kelley Island Lime and Transport Co.	May 27	100	120	121	$2 quar. Apr. 1
Lawrence Portland Cement Co.[2]	June 7	100	105	110	2% quar.
Lehigh Portland Cement Co.[6]	June 7	50	86	88	1½% quar.
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, expire serially up to 1930)[13]	June 4	100	99	100	
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, expire serially from 1930 to 1935)[13]	June 4	100	97	99	
Michigan Limestone and Chemical Co. (common)[6]	June 5	.....	24	26	
Michigan Limestone and Chemical Co. (preferred)[6]	June 5	.....	23	24½	1¾% quar. Apr. 15
Missouri Portland Cement Co.	June 9	25	57	57½	25c quar. May 31, 25c ex. May 31
Monolith Portland Cement Co. (common)[9]	June 4	.....	11	11½	
Monolith Portland Cement Co. (units)[9]	June 4	.....	27	28	
Monolith Portland Cement Co. (preferred)[9]	June 4	.....	8	8½	
Nazareth Cement Co.[20]	June 4	No par	38	39	75c quar. Apr. 1
Newaygo Portland Cement Co.[1]	June 4	.....	110	120	
New England Lime Co. (Series A, preferred)[14]	Jan. 29	100	96½	99	
New England Lime Co. (Series B, preferred)[22]	June 7	100	92	95	
New England Lime Co. (V.T.C.)[22]	June 7	.....	35	38	
New England Lime Co. (6s, 1935)[14]	June 4	100	99	100	
North American Cement Corp. 6½s 1940 (with warrants)	June 9	.....	97	97	
North American Cement Corp. (units of 1 sh. pfd. plus ½ sh. common)[19]	Apr. 8	.....	94	99	2 mo. period at rate of 7%
North American Cement Corp. (preferred)	Dec. 31	.....	.....	.....	1.75 quar. May 1
Pacific Portland Cement Co., Consolidated[5]	June 4	100	90	.....	½% mo.
Pacific Portland Cement Co., Consolidated (secured serial gold notes)[5]	June 4	.....	99¾	100½	3% semi-annual Oct. 15
Peerless Portland Cement Co.[1]	June 4	10	5¾	6¼	
Petoskey Portland Cement Co.[1]	June 4	10	9½	10	1½% quar.
Rockland and Rockport Lime Corp. (1st preferred)[10]	May 25	100	98	98	3½% semi-annual Feb. 1
Rockland and Rockport Lime Corp. (2nd preferred)[10]	Apr. 8	100	.....	70	3% semi-annual Feb. 1
Rockland and Rockport Lime Corp. (common)[10]	Apr. 8	No par	.....	50	1½% quar. Nov. 2
Sandusky Cement Co. (common)[1]	May 27	100	106	135	$2 quar. Apr. 1
Santa Cruz Portland Cement Co. (bonds)[5]	June 4	.....	105⅛	.....	6% annual
Santa Cruz Portland Cement Co. (common)[5]	June 4	50	82	.....	$1 quar. $1 ex. Dec. 24
Superior Portland Cement, Inc. (new stock)[20]	June 3	.....	42	42	
United Fuel and Supply Co. (sand and gravel) 1st Mort. 6s[27]	June 4	100	99¾	100	
United Fuel and Supply Co. (sand and gravel) 6% gold notes[27]	June 4	100	98¾	99	
United States Gypsum Co. (common)	June 9	20	144¾	146	2% quar., $1 ex. May 31
United States Gypsum Co. (preferred)	June 9	100	115½	117	1¾% quar. June 30
Universal Gypsum Co. (common)[3]	June 10	No par	15½	16	
Universal Gypsum V.T.C.[3]	June 10	No par	15¼	15¾	
Universal Gypsum Co. (preferred)[3]	Aug. 5	.....	76	.....	1¾% quar. Sept. 15
Universal Gypsum Co. (1st Mortgage 7% bonds)[3]	June 10	.....	99	(at 6½%)	
Union Rock Co. (7% serial gold bonds)[15]	June 4	100	98½	101	
Wabash Portland Cement Co.[1]	Aug. 3	50	60	100	
Wisconsin Lime and Cement Co. (1st Mort. 6s, 1940)[15]	May 24	100	98½	100	
Wolverine Portland Cement Co.	June 9	10	6	6½	2% quar. Aug. 15

[1]Quotations by Watling, Lerchen & Co., Detroit, Mich. [2]Quotations by Bristol & Willett, New York. [3]Quotations by True, Webber & Co., Chicago. [4]Quotations by Butler, Beading & Co., Youngstown, Ohio. [5]Quotations by Freeman, Smith & Camp Co., San Francisco, Calif. [6]Quotations by Frederic H. Hatch & Co., New York. [7]Quotations by F. M. Zeiler & Co., Chicago, Ill. [8]Quotations by De Fremery & Co., San Francisco, Calif. [9]Quotations by A. E. White Co., San Francisco, Calif. [10]Quotations by Lee, Higginson & Co., Boston, Mass. [11]Nesbitt, Thomson & Co., Montreal, Canada. [12]E. B. Merritt & Co., Inc., Bridgeport, Conn. [13]Peters Trust Co., Omaha, Neb. [14]Second Ward Securities Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois, Chicago. [16]J. S. Wilson Jr. Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hemphill, Noyes & Co., New York. [20]Quotations by Bond & Goodwin & Tucker, Inc., San Francisco. [21]Baker, Simonds & Co., Inc., New York. [22]William C. Simons, Inc., Springfield, Mass. [23]Blair & Co., New York and Chicago. [24]A. B. Leach and Co., Inc., Chicago. [25] A. C. Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [27]J. G. White and Co., New York.

QUOTATIONS ON INACTIVE ROCK PRODUCTS CORPORATION SECURITIES ON PAGE 72

Editorial Comment

Aggregate Specifications

Elsewhere in this issue is printed the full text of the tentative specification for concrete aggregate which the American Concrete Institute now has under consideration, of which an abstract was published in the March 6 issue of ROCK PRODUCTS. The report has been criticized in some quarters, and it is open to criticism. Nevertheless it seems that the committee has done the best it could with a very difficult job.

The difficulty of writing a specification for aggregates which would apply to the whole United States as well as all the uses of concrete seems to grow as one studies the subject. In parts of the United States where aggregate of the best quality is plentiful and cheap it would be proper to write a stiff specification that would throw out any but the best materials. In localities where if concrete is to be made at all it must be made of such materials as are at hand, the same specification might bar about everything that was available locally. Climate is another factor. In a part of the country where frosts are light and the winters are short aggregates may be used which a soundness test would throw out where winters were severe.

There are a few characteristics which all aggregates must have if their use is to be permitted at all. These seem to have been well covered in the paragraphs headed "General Characteristics." Beyond this the committee has recommended rather than set exact limits, in specifying grading, cleanliness and the like. But this is a long step in advance. The producer can use these recommendations with telling effect in combating the sale of unfit material. He has also a standard which it is reasonable to suppose will be nationally accepted by which he may judge the quality of his product.

To Stabilize Business

A scheme which will have a profound effect on the rock products industries, if it is carried out, is that of avoiding the recurrence of periods of expansion and depression, sometimes called the "business cycle." A report on this was made by a committee headed by Secretary of Commerce Hoover in 1921. This report has been followed by intensive study by investigators of the Russell Sage Foundation, which has recently made its report.

The difficulty of carrying out any plan for lessening the effect of the business cycle was found to be that the facts are not known in time to prevent a period of depression. The Russell Sage Foundation investigators propose to remedy this by the collection of employment statistics by the state labor bureaus, with the United States Department of Labor as the coordinating center. Other government departments such as the Geological Survey, the Interstate Commerce Commission and the Department of Agriculture are to contribute information. The rock products industries are among those especially mentioned for study.

The stabilizing effect of the Federal Reserve System, which controls credit on the basis of fact-finding, is given as an example of the value of available information concerning the state of industries throughout the country.

One excellent result of such a finding of the facts concerning a particular industry might well be that investors would be more careful about putting money into new enterprises. One of the worst features of the business cycle is the ease with which promoters can raise money in a period of strong demand to build plants, the output of which only serves to further depress a bad market in the period of lessened demand which follows.

Concrete Disintegration

Whenever concrete disintegrates the blame is usually laid upon the contractor who did the work. It is usual to surmise that insufficient cement was used or the concrete was not properly mixed and placed. But the use of unfit aggregate may just as reasonably be the cause, and there is beginning to be a sufficient body of evidence to prove that it usually is.

The report and appendices of the committee on destructive agents and protective treatments of the American Concrete Institute, made at the February meeting, give five examples of serious disintegration of concrete. In four of these the fault is laid to the use of unfit aggregate in the concrete. In the fifth, the reason assigned is too lean a mixture and excess of water, but it is to be noted that pit-run sand was used on this job. Specifically, the causes assigned for disintegration in the other cases were: Use of too fine a sand; a poor quality of coarse aggregate that broke down on exposure to the atmosphere; sand which was too fine to use in concrete exposed to sea water, and which contained organic matter; and the use of a shaly coarse aggregate in combination with a fine sand not well graded.

Producers of aggregate do not need to be told the importance of structurally sound, clean and well graded aggregates in making concrete. Neither do the better class of engineers and architects. But there still remains a class of buyers and users of aggregate who keep the wayside pit and the sand bar producer in business and who need to have it pointed out continually that concrete can be no better than the materials of which it is made.

QUOTATIONS OF INACTIVE ROCK PRODUCTS SECURITIES

Stock	Date	Par	Price bid	Price asked	Divided rate
Coplay Cement Mfg. Co. (common) (4)	Dec. 16	.....	12½	.....	
Coplay Cement Mfg. Co. (preferred) (1)	Dec. 30	.....	70	.....	
Eastern Brick Corp. 7% cu. pfd.) (1)	Dec. 9	10	40c	.....	
Eastern Brick Corp. (sand lime brick) (common) (1)	Dec. 9	10	40c	.....	
Edison Portland Cement Co. (common)	Nov. 3	50	7½c(x)	.....	
Iroquois Sand & Gravel Co., Ltd. (2 sh. com. and 3 sh. pfd.) (1)	Mar. 17	.....	$12 for the lot	.....	
Edison Portland Cement Co. (preferred)	Nov. 3	50	17½c(x)	.....	
Lime and Stone Products Co. (1100 sh. pfd., $10 par and 700 sh. com., $10 par)	Feb. 10	.....	$66 for the lot	.....	
Missouri Portland Cement Co. (serial bonds)	Dec. 31	.....	104¾	104¾	3¼ % semi-annual
Olympic Portland Cement Co. (g)	Oct. 13	.....	.....	£1⅝	
Phosphate Mining Co. (1)	Nov. 25	.....	1@5	.....	
Pittsfield Lime and Stone Co. (preferred)	.....	100	.....	.....	2% quar. Apr. 1
Rock Plaster Corp. (390 sh. com., no par) (1)	Mar. 17	.....	$12 for the lot	.....	
Simbroco Stone Co. (pfd.)	Dec. 12	.....	.....	.....	$2 Jan. 1
Tidewater Portland Cement Co. (common) (3)	Nov. 25	.....	8½	.....	
Vermont Milling Products Co. (slate granules) 5 sh. pfd. and 1 sh. com. (2)	Dec. 30	.....	$1 for the lot	.....	
Winchester Brick Co. (preferred) (sand lime brick) (5)	Dec. 16	.....	10c	.....	

(g) Neidecker and Co., Ltd., London, England. (1) Price obtained at auction by Adrian H. Muller & Sons, New York. (2) Price obtained at auction by R. L. Day and Co., Boston. (3) Price obtained at auction by Weilepp-Bruton and Co., Baltimore, Md. (4) Price obtained at auction by Barnes and Lofland, Philadelphia, Pa. (5) Price obtained at auction for lot of 50 shares by R. L. Day and Co., Boston, Mass. (x) Price obtained at auction by Barnes and Lofland, Philadelphia, on November 3, 1925.

Warner Common for Employes

A STATEMENT was recently issued to the employes of the Charles Warner Co., Wilmington, Del., by Charles Warner, president, calling attention to the investment value of "Warner common." This is now selling at about $24 per share, with a dividend return of 8⅓%. Mr. Warner emphasizes his desire that employes shall take this stock for the "long pull" rather than for speculative purposes.

Signal Mountain Dividends

AT a recent meeting of the directors of the Signal Mountain Portland Cement Co., Chattanooga, Tenn., the usual preferred stock dividend was declared. The initial dividend on no par common stock was also authorized to be paid on September 1 at the rate of $1.50 per share.

International Cement Quarterly Report

FROM the tabulation given below, the net to surplus for the first quarter of 1926 amounts to $746,172 as compared with $713,939 for the first quarter in 1925. These earnings, after allowing for preferred dividends, are equivalent to $1.15 per share for the quarter on 500,000 shares of common stock outstanding. H. Struckmann, president of the International Cement Corp., in his report says:

On account of the unusually inclement weather generally over the United States, shipments during the first quarter were below expectations. However, with building permits and general construction work at a high level, we believe work has merely been delayed, and that shipments will be satisfactory with the advent of good weather conditions.

Over $32,000,000 of Rock Products Securities Sold During Present Year

FROM January 1 to June 1 of the present year different bankers and investment houses sold over $32,000,000 of rock products securities. That these securities are regarded as a high grade investment is best evidenced by the prices at which they are quoted, which are, in practically every case, at par or very near par. This large amount of new financing was made necessary because of various expansions, construction and consolidations of interests that are now going on in the various branches of the industry.

The following is a partial list of securities issued by different companies and the purpose for which they were issued:

Dexter Portland Cement Co. $2,200,000, 6% bonds. In connection with the purchase of the Penn-Allen Cement Co.

North American Cement Corp. $1,650,000 bonds and $850,000 in stock. To pay in part for purchase of Acme Cement Corp. and provide additional working capital.

Marquette Cement Mfg. Co., $3,000,000. To reimburse treasury for improvements and additions to plants.

New Egyptian Portland Cement Co., $475,000 bonds and $600,000 in stock. To provide new working capital and pay for improvements.

Beaver Portland Cement Co., $400,000. To provide for increase in plant capacity.

Petoskey Portland Cement Co., $1,000,000. To provide additional capital.

Consolidated Cement Corp., $5,110,000. To acquire businesses and properties of the Peninsula Portland Cement Co., Fredonia Portland Cement Co. and the Great Western Portland Cement Co.

Superior Portland Cement, Inc., $4,500,000. To purchase plant and properties of Superior Portland Cement Co.

United Fuel and Supply Co., $4,400,000. To purchase plants and properties of Superior Sand and Gravel Co., United Fuel and Supply Co. (old company), Superior Plaster Co., Birmingham Sand and Gravel Co., Delta Brick and Tile Co. and various shipping lines.

Consumers Rock and Gravel Co., $500,000. To build a new plant and make improvements to other plants.

Blackwater Stone Co., $85,000. To discharge building obligations and provide additional capital.

Lincoln Sand and Gravel Co., $100,000. To refund bonds and provide additional capital.

Consolidated Sand Co. (Canada), $415,000. To provide for expansion.

Indiana Limestone Co., $5,000,000. To pay for purchase of plants in Bedford-Bloomington district entering into consolidation.

[This list does not include such financing as that completed within various companies and consequently not offered to the public and which would probably show a much greater amount of capital to be added to that already invested.]

Alpha Portland Changes Capital

STOCKHOLDERS of the Alpha Portland Cement Co., Easton, Penn., have voted to change the authorized capital stock from $23,000,000 to 1,000,000 shares of common stock of no par value. The old stock, of which there was $15,800,000 outstanding, had a par value of $100 per share. Part of the new issue will be exchanged for the outstanding common on a basis of three shares of the new for each share of the old. Annual dividends of 6% have been paid regularly since 1923 on the common stock.

Inventory of Dickinson Estate

INVESTMENTS of the late William Dickinson, vice-president of the Marquette Cement Manufacturing Co., Chicago, Ill., who died January 27, were revealed in an inventory of his estate.

Mr. Dickinson owned 6,686 shares of preferred and 7,300 shares of common stock in the company of which he was an official. These were valued at $899,880. —*Chicago (Ill.) Tribune.*

COMPARATIVE FIRST QUARTER REPORTS OF THE INTERNATIONAL CEMENT CORP.

3 month ended March 31	1926	1925	1924	1923
Gross sales, less discount, allowances, etc.	$3,989,855	$3,131,625	$2,431,957	$2,184,773
Cost of sales	2,003,417	1,509,353	1,202,455	1,050,846
Depreciation	252,415	171,355	182,501	179,633
Manufacturing profit	$1,734,024	$1,450,917	$1,047,002	$954,293
Selling, administrative and general expenses	806,529	573,434	504,079	400,501
Net profit	$927,495	$877,483	$542,923	$553,792
Miscellaneous income	.....	Cr. 8,014	Cr. 195	Cr.6,771
Reserve for federal tax, etc.	180,106	171,558	101,106	100,353
Net to surplus	$746,172	$713,938	$442,013	$460,210

Merger of Twenty Sand Plants

Kaw and Arkansas River Producers Form a $2,500,000 Combination

THE formation of the merger including many of the producers operating sand dredges on the Kaw and Arkansas rivers in Kansas was officially announced on May 29. The causes which led to the merger and the territory in which it operates were discussed in ROCK PRODUCTS for April 17. This is not an exceptionally large combination from the point of invested capital, as mergers go nowadays. But it is large as regards the number of companies interested and important as showing the trend of the rock products industries today. The proprietors of the plants that have combined had their choice between a fight that would leave a few badly crippled survivors, and a business which would remain in a disorganized condition for years to come, and the formation of a company which would produce only as the market could take the production, relying for its profits on the law of averages. The consumers will benefit by better service, absorption of switching charges, prompt deliveries, and eventually a lower price.

The Companies Included

The companies included are: the Topeka Sand Company, Wear Sand Company, Stewart-Peck Southwestern Sand Company, and Fowler Sand Company of Topeka; Rock Island Sand Company and Manhattan Sand Company of Manhattan; Amerman Sand Company of Sterling; Hutchinson Supply Company; Western Sand and Gravel Company; Empire Sand and Material Company; Busch Sand Company and Swartz Lumber and Sales Company of Wichita; Jackson & Walker Coal and Mining Company of Mulvane, and Arkansas River Sand Company of Oxford. These companies operate 20 plants along the Kaw and Arkansas rivers.

F. A. Laughead of Topeka is president of the company; F. H. Gades, vice-president; A. N. McQuown, secretary-treasurer, and H. N. Richardson, assistant secretary-treasurer. Directors include H. H. Allison, Salina; M. R. Amerman, D. M. Anderson, H. A. Swartz, R. G. Carden, Wichita; D. D. Eshelman, Oxford; Colonel Lee Hunt, Kansas City, and C. E. Brown, Hutchinson, Kas.

The officers of the company are men long identified with the building material interests of Kansas and adjoining states.

F. A. Laughead, president of the combination and one of its promoters

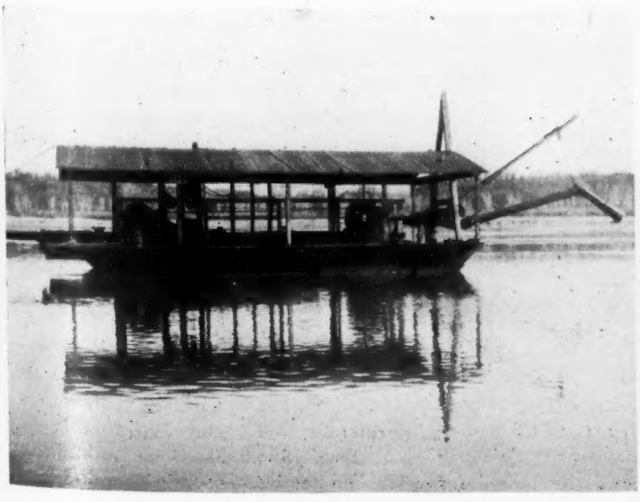
Incroporated Under Delaware, Kansas and Oklahoma Laws

The company has been incorporated under the laws of the state of Delaware for $2,500,000. Charters have also been obtained in Kansas and Oklahoma to permit doing business in these states. The usual form of incorporation has been followed, that is, bonds have been sold, with the plants and equipment as security, and issues of preferred and common stocks have been made. The main offices of the company will be in Topeka, but the territory has been divided into districts, each of which will be in charge of a district manager.

One of the interesting features of this combination was the survey of resources that was made before financing was begun. It was found that, with the present rate of increase in production, twenty years working would exhaust the sand in the Kaw and Arkansas rivers, leaving only the "make in" sand brought in each year as a source of supply. Some of this high rate of exhaustion was due to not working the rivers systematically. The new combination will remedy this by clean and systematic excavation of the sand from the river bottoms to make this great resource of an important building material last as long as possible.

So far nothing has appeared in the newspapers to indicate that the new combination will be attacked as a "combination in restraint of trade." The organizers of the merger were careful not to violate state or federal laws and the merger does not include all of the plants operating in the territory which is to be covered.

Plant of the Empire Sand and Material Co.



Dredge, typical of those used on the Arkansas river

Fowler Sand Co.'s plant at Topeka, Kansas

Plant of Southern Material and Construction Co. consolidated with Big Rock Stone Co. of Little Rock, Ark.

Big Rock Stone Co. Joins Sand Producing Company

THE Big Rock Stone Co. of Little Rock, Ark., has purchased the sand plants of the Southern Material & Construction Co. of Little Rock and has changed its name to the Big Rock Stone and Material Co.

The quarry and plant of the Big Rock Stone Co. was described in the May 29 issue of ROCK PRODUCTS. The Southern Material and Construction Co. is a large corporation that is well known as a contracting company for the more important kinds of construction throughout the southern states. It has produced the greater part of the sand used in Little Rock and runs a building material business and operates a mixed concrete plant.

The company operates a dredge on the Arkansas river and has its principal plant almost in the heart of the city. This has a capacity for 60 cars per day, and shipments may be made over either of two of the main lines entering Little Rock, as the plant stands between the tracks.

Continue Hearing on Greater New York Sand Dealers' Association

JOSEPH J. RYAN of Brooklyn, vice-president of N. Ryan & Co., was the only witness to testify at the resumption of the attorney general's investigation to determine if the Greater New York Sand and Gravel Dealers' Protective Association constituted a monopoly. The hearings are before Referee Edward J. Byrne at the Supreme Court Building, Brooklyn. (For details concerning the association and its organization see ROCK PRODUCTS, May 15 and 29 issues.)

Mr. Ryan is treasurer of the association, of which his company is a member. One of the principal objects of the organization, he testified, is to furnish credit information to member companies, and to prevent unreliable buyers from changing from one concern to another. There are eleven member firms, Ryan said, each contributing $500 when the association was formed and then paying $30 a month dues.

In answer to a question by Deputy Attorney General Ullman, Mr. Ryan said more than $8,000, which was believed to have been irrevocably lost to the association members through bad accounts, had been collected for them by the credit man the association employed. In one instance, he said, $4,000 due five years was collected.

All such money, although collected by the association, was turned over to the individual member to whom it was owed, Mr. Ryan said.

The hearing was then adjourned to a later date.—*Brooklyn (N. Y.) Times.*

New Plant of the Bakersfield Rock and Gravel Company

THE large new modern plant of the Bakersfield Rock and Gravel Co., which is being built at a cost of about $150,000 near Bakersfield, Calif., is expected to be in operation within a short time. It is equipped to produce about 100 tons of washed and screened sand and gravel per hour. Crushers, screens, conveyors and other equipment will be operated by electric power and there are 17 motors installed for the purpose. A most interesting feature is the installation of a riffle above the sand washer to catch the gold which is in the sand.

The plant was designed and constructed by J. R. Hughes, formerly with Stone & Webster. Mr. Hughes is one of the organizers of the company, and will remain as production manager.

The officers and directors of the company are business men of the district. A. H. Karpe is president; J. B. Dowd, vice-president; C. F. Smith, secretary and treasurer; J. N. Harvey, Fred C. Macomber, J. R. Hughes and George W. McCutcheon, directors.—*Bakersfield (Calif.) Californian.*

Gravel Company to Operate Near Madison

THE newly organized Tiffany Sand and Gravel Co. is reported to have purchased 60 acres at Tiffany, Wis., near Madison, on which a modern sand and gravel plant will be erected. The company is capitalized for $125,000.

The property purchased fronts on one railroad and is near another and is said to be one of the finest gravel deposits in the state.

It is planned to install stock pile rigging and drag bucket equipment, with belt conveyors, which will permit of continuous operations.

Officers of the new concern are: President, J. M. Price, Ramsay, Mich.; vice-president and general manager, Fred T. Kern; treasurer, George W. Paine, and secretary, R. Alger Dake, all of Milwaukee. The office of the company is at 650-654 Lawton place, Milwaukee.—*Milwaukee (Wis.) Sentinel.*

Macatee New District Engineer for Florida

W. R. MACATEE has recently been appointed district engineer in charge of the Florida office of the Portland Cement Association at Jacksonville.

Mr. Macatee's work will cover the state of Florida excepting that portion west of the Georgia-Alabama line, which is in the jurisdiction of the Birmingham office.

Mr. Macatee has had wide experience in this field, prior to ten years ago having spent three years in the employ of the Edison Portland Cement Co. and the Tidewater Portland Cement Co. He was engaged in sales promotion work with these companies. During the last 10 years he has been engaged in road promotion work throughout the southeastern states. Mr. Macatee is a native of Virginia and for two years during the World War served as a captain in the Marine corps.

Moline Consumers Company Receives Large Contract

The Moline Consumers Co. has been awarded a contract for 175,000 tons of gravel for the Illinois waterway lock which is being constructed by the state at Starved Rock.

The greater part of the material will be shipped to Starved Rock from the Ottawa plant of the Moline concern, it was stated. Some will be sent from Moline. The order represents 4,200 carloads of gravel.—*Davenport (Iowa) Times.*

Pope Honors Cornelius Gallagher

THE order of Knight of St. Gregory has been conferred by Pope Pius XI upon Cornelius Gallagher, former vice president and general manager of the National Conduit & Cable Company, according to a recent announcement. Mr. Gallagher is the father of J. J., J. V. and F. F. Gallagher, who are all officers of the Goodwin-Gallagher Sand & Gravel Corp., New York. Cardinal Hayes presented the decoration to Mr. Gallagher at the cardinal's residence on Monday night. Mr. Gallagher, who is 82 years old, was born in Ireland, but came to this country as a child. Since his retirement in 1916 he has ben active in church affairs.—*New York Times.*

Charles H. Ray

Cornelius N. Ray
President C. N. Ray Corp.

George F. Barr

United Fuel and Supply Co. Now Known as Ray Sand and Gravel Co.

THE United Fuel and Supply Co. of Detroit, Mich., is now known as the Ray Sand and Gravel Co. and it has become one of the group of companies organized under the name of the C. N. Ray Corp.

According to information received from the company, the change in name is an incident of the sale of practically all the retail business of the United Fuel and Supply Co. with accompanying equipment together with some retail city yards. The purchasers are men controlling large eastern and Detroit interests. An account of the financing in connection with this purchase was published in ROCK PRODUCTS in the April 17 issue.

The history of this sand and gravel producing organization goes back to 1898 when it was organized as the C. H. Little Co. At that time it brought sand in small sailing vessels to Detroit and sold it at the wharf for "ten cents a carload." The hand shovel did the work that now is performed by locomotive cranes and clamshell buckets, and horses and wagons did what is now the work of hundreds of feet of conveyor belts, cranes and trucks. A few flat screens set up on the wharf have grown to immense modern washing and screening plants designed and operated by trained engineers. The slow and uncertain sail boats have been replaced by railroad trains and a fleet of steel steamships.

The Ray Sand and Gravel Co., while it is a division of the C. N. Ray Corp., has its own officers. Charles H. Ray is its vice-president and general manager. The other officers are: George F. Barr, president, and James F. Donnellon, secretary and treasurer. Louis E. Williams is manager of plants, director and assistant secretary and William L. Nellis is assistant treasurer. J. J. Haarer and F. L. Comeau, who have been actively engaged for years in specialized sales work for the United Fuel and Supply Co. will continue in this work with the Ray Sand and Gravel Co.

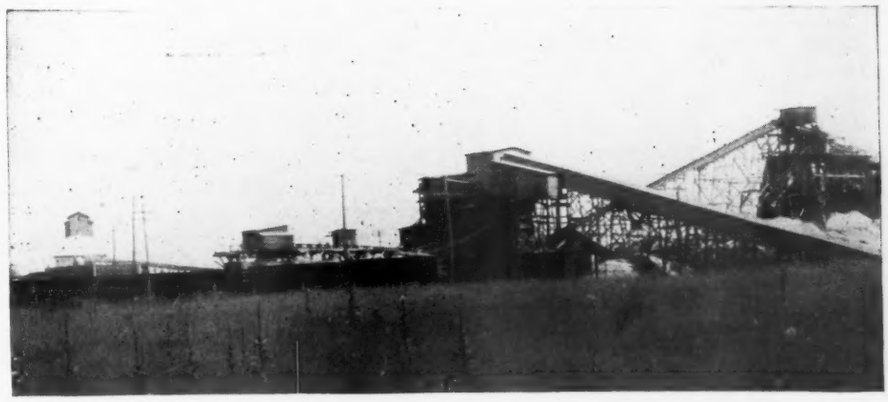
The company operates plants at Oxford, New Hudson and Utica, Mich. It will also handle the production of other large companies.

The other divisions of the C. N. Ray Corp. are the Ray Fuel Co., the Ray Land Co. and National Services, Inc. The last named is to furnish active and advisory service on insurance, on matters before federal and state departments, and to make researches. The officers of the C. N. Ray Corp. remain the same, C. N. Ray being president; George F. Barr, vice-president and treasurer; Charles H. Ray, secretary; James F. Donnellon, assistant secretary, and William L. Nellis, assistant treasurer. The offices of all the companies are in the Book Building, Detroit.

Louis E. Williams

William L. Nellis

James F. Donnellon



Oxford, Mich., plant of the Ray Sand and Gravel Co., formerly United Fuel and Supply Co.

Work on Santa Rosa Plant Expected to Start

WORK on the new plant of the Santa Rosa Portland Cement Co., to be located at St. Stephens, Ala., will probably start within a short time, according to the Birmingham office of the H. K. Ferguson Co., which has the contract for designing, building and buying the equipment for the plant.

The plant will have two kilns at the start, with provisions for a third. Cement is to be shipped in bulk by the company barges to Mobile, Tampa and New Orleans for sacking and distributing. The plant at St. Stephens will be located on the bank of the Tombigbee river, about 60 miles above Mobile. The bulk cement will be loaded by machinery directly from the storage silos to the barges.

Hearing on Increased Duty on Magnesite

THE proposed increase in the duty rates on crude and caustic magnesia will be taken under consideration at a public hearing to be held on June 21 before the U. S. Tariff Commission. Application for this increase has been made by the Sierra Magnesite Co., Chicago, and C. S. Maltby, San Francisco.

Present duty rates on crude magnesite and caustic magnesite are $6.25 and $12.50 per short ton, respectively. The rate specified is equal to an ad valorem rate of 69% of the declared value in 1925 of lump caustic magnesite from India and 39% of the 1925 declared value of ground caustic magnesite from the Netherlands, where Grecian caustic magnesite is ground.

Kosmos Cement Co. Develops Water Transportation

THE Kosmos Portland Cement Co., of Louisville and Kosmosdale, Ky., has been gradually developing a river transportation company of its own. For twenty years or more the company towed rock from King's Landing 25 miles below Kosmosdale, Ky., to its cement mills, or had the rock towed in its own barges.

Gradually a volume of business was developed through dealers in the Cincinnati market which warranted towing of barges of cement to Cincinnati, where deliveries were made from these barges to dealers, or for dealers to jobs on which dealers were making deliveries. A towboat was under charter to the company for handling these upstream movements.

More recently the company had three towboats built, equipped with Diesel oil engines and twin screw propellors, and discarded its old wooden barges, now using eight all-steel barges. Most of these barges are compartment barges, divided into eight compartments and arranged so that they can tow cement to Cincinnati as a deck load, and after being emptied are towed over to crude oil loading stations in eastern Kentucky, where they are loaded with crude oil and towed to Louisville refineries, being unloaded by pump.

The boats carry three loaded barges at a trip. Barges of cement are held under load at Cincinnati, until contents are delivered, instead of transferring to warehouse.

So far the company has been handling only cement and oil, but may develop its transportation department for handling general lines, under a plan which would materially reduce cost of handling its own cement and in time result in a profit on transportation. As a result of long years of work on the part of the government in constructing locks and dams on the Ohio river, a very steady boating stage between Louisville and Cincinnati is now available, which eventually will extend to the mouth of the Ohio river, and with this enlargement and improvement of facilities for river freight handling, there is a very much improved volume of business available for the transportation companies.

Under the new plan of operation the company with its own equipment is handling all rock from the quarries at King's Landing to the cement mills and all cement deliveries to Ohio river points, where it has business, plus the Cincinnati business. Right now the concern is offered more oil towing downstream than it has cement going up, with the result that some empties are taken on upstream movement, to be available for bringing oil back. Development of transportation to a point where all tows will be full both ways will place the transportation department in excellent shape.

John J. Sloan Is Poisoned by Gas from His Motor

JOHN J. SLOAN, president of the board of local improvements of Chicago and former president of the National Crushed Stone Association, has been confined to his home for the last week suffering from carbon monoxide gas poisoning. He was taken ill while directing work on the Wacker drive in Chicago. He at first attributed his condition to overwork, but an examination of his automobile, ordered by his physician, revealed that gases were entering the tonneau from two leaks in the exhaust pipe.—*Chicago Tribune.*

National Cement of Canada Plans Toronto Plant

NATIONAL CEMENT CO., LTD., and Credit Canada, Ltd., interests are reported to have secured an option on a limestone deposit near Toronto and negotiations are said to be under way for the formation of a new cement company, which will build practically the duplicate of the National Cement Co.'s plant at Montreal. The new company to operate in the Toronto district will be capitalized with $1,500,000 bonds; $1,500,000 of 7% preferred stock and 50,000 shares of no par value common stock. The new plant will be modern in every respect, with a capacity of 900 bbl. of cement per day. The reason of the new plant is to avoid the freight from the Montreal plant and thus enable them to compete more favorably for the trade in the Toronto field.

Florida Building Materials to Get Government Survey

THE Department of Commerce has recently announced that it will undertake a special survey of certain economic factors affecting transportation in the state of Florida at the request of the Florida Shippers Regional Advisory Board. The survey will cover the commodity movements, including production, turnover, stocks on hand and distribution of cement, tile, sand and gravel, lime rock, asphalt and other materials.

The survey will seek to determine the consuming ability as well as the commodity movements within the state. A. Lane Cricher of the transportation division of the Department of Commerce, has been chosen director of the survey. He will, within a short time, meet with the executive committee of the Florida Shippers Regional Board to plan the work.—*Washington (D. C.) Star.*

A. C. Horner Joins Portland Cement Association

A. C. HORNER, building inspector for the city of Stockton, Calif., for the past three years, has resigned to take up promotion and research work for the Portland Cement Association. Mr. Horner had a wide engineering experience before taking up his inspection duties at Stockton and is the present secretary of the Pacific Coast Building Officials Conference, which has been very active in promoting a proposed uniform building code for the Pacific coast. In his new capacity, Mr. Horner will make his headquarters at the Los Angeles office of the Portland Cement Association. — *Stockton (Calif.) Record.*

New Cement Merger Rumored

A DISPATCH from Chattanooga, Tenn., published in the *New York Sun* of June 7, says that a merger of seven of the largest eastern and middle-western cement producing companies is rumored. It is intimated that the Dixie Portland Cement Co., which has its main offices in Chattanooga and its plant at Richard City, Tenn., will join the merger.

Alabama Portland to Change to Wet Process

THE Alabama Portland Cement Co. plant at Birmingham is to be changed this fall from the dry process to the wet. Engineering work is now in progress. The necessary machinery for the change will be installed during the next few months.

Traffic and Transportation

EDWIN BROOKER, Consulting Transportation and Traffic Expert
Munsey Building, Washington, D. C.

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning June 7:

Central Freight Association Docket

13304. **Crushed stone**, carloads, Kenton, Ohio, to points on the Hocking Valley Railway shown below. Present rates—Present rates are as per Agent B. T. Jones' Tariff I. C. C. 940. Proposed (rates in cents per ton of 2000 lb.) to Ohio—Lancaster, Logan, Dundas, 90; Radcliff, Hawks, Mineton, Vinton, 110; Glenns, Bidwell, Evergreen, Kerrs, Gallipolis, Kanauga, Addison, Cheshire, Middleport, Pomeroy, 120.

13324. **Crushed stone**, carloads, Narlo, Ohio, to Akron, Ohio. (Restricted to route via Bellevue, Ohio, and Pennsylvania R. R.) Present rate, 90 cents per ton of 2000 lb.; proposed, 80 cents per ton of 2000 lb.

13341. **Crushed stone**, carloads, Maple Grove, Ohio, to Akron, Ohio. Present rate, 90 cents per net ton; proposed, 80 cents per net ton.

13355. **Sand** (except blast, engine, filter, fire or furnace, foundry, glass grinding or polishing loam, molding or silica) and gravel, carloads, Hadley and Jamestown, Penn., to Alsace, Penn. Present rate $3.10 per net ton; proposed, $1.15 per net ton.

3356. **Crushed stone**, carloads, Ransoms, Ohio, to (via B. & O. R. R.) Alta, Lexington, Belleville, Lockhart, Gatton Rock, Butler, Ankentown, Fredericktown and Mt. Vernon, Ohio. Present rate, $1.10 per net ton; proposed, $1 per net ton.

13357. **Crushed stone**, carloads, Ransoms, Ohio, to Mansfield, Ohio (via B. & O. R. R.). Present rate, $1.10 per net ton; proposed, 90 cents per net ton.

13358. **Sand** (except blast, core, engine, filter, fire or furnace foundry, glass, grinding or polishing, loam, molding or silica) and gravel, carloads, Cleveland, Ohio, to Northfield, Ohio. Present rate, 90 cents per net ton; proposed, 60 cents per net ton.

13363. **Sand and gravel**, carloads, Hobson, Middleport, Pomeroy, Cheshire, Kenaugh, Galliopolis, Ohio, and Point Pleasant, W. Va., to Athens, Ohio. Present rate, 90 cents per net ton; proposed, 80 cents per net ton.

13364. **Crushed stone (in bulk)**, carloads, Sandusky, Ohio, to Detroit, Mich. Present rate, $1.96 per net ton; proposed, $1.15 per net ton.

13365. **Sand and gravel**, carloads, Cleveland, Ohio, to Mentor, Ohio. Present rate, 70 cents per ton of 2000 lb.; proposed, 65 cents per ton of 2000 lb., the rate not to include cost of loading or unloading from docks to cars.

13366. **Crushed stone**, carloads, St. Paul, Ind., to Collage Corner, Ind.-Ohio, via C. C. C. & St. L. Ry. and C. I. & W. R. R. Present rate, sixth class; proposed, $1.05 per net ton.

13369. **Sand**, viz.: Blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, carloads, Falconer, N. Y., to various points in Indiana and Michigan. Present rates—Per Agent B. T. Jones' Trf. I. C. C. 1534. Proposed rates—(In cents per ton of 2000 lb.)

To—	Rate
Anderson, Ind.	290
Grand Rapids, Mich.	378
Flint, Mich.	328
Fort Wayne, Ind.	315
Indianapolis, Ind.	315
Kokomo, Ind.	328
Marion, Ind.	390
Port Huron, Mich.	328
South Haven, Mich.	378

13372. **Sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing loam, molding or silica) and gravel, carloads, Lafayette, Ind., to Kersey and Grape Island, Ind. Present rate, 80 cents per net ton; proposed, 69 cents per net ton.

13376. **Sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) and gravel, carloads. From North East, Penn., to Wickliffe, Ohio, and intermediate N. Y. C. R. R. stations west of Swanville, Penn. Proposed, 65 cents; present rate, $1.10.

From Jamestown, Penn., to Wickliffe, Ohio, and intermediate N. Y. C. R. R. stations north of Dorset, Ohio, and west of Ashtabula, Ohio. Proposed rate, 65 cents; present rate, 90 cents.

From Cleveland, Ohio, to Geneva, Ohio, and intermediate N. Y. C. R. R. station east of Wickliffe, Ohio. Proposed rate, 65 cents; present rate, 90 cents.

Present rates published in N. Y. C. R. R. I. C. C. L. S. 1307.

13394. **Crushed stone**. Carloads, St. Paul, Ind., to C. C. C. & St. L. Ry. stations, viz.: Branch, Trafalgar, Samara, Morgantown, Williams Crossing, Mahalaville, Taggart and Martinsville, Ind. Present rate 92 cents per net ton, except to Taggart and Mahalaville, 95 cents per net ton. Proposed, 85 cents per net ton.

13411. **Crushed stone**, carloads, Holland, O., to Addison and Hillsdale, Mich. (See note.)

Note—Proposed rate to expire after sixty days from the date rate takes effect.

Present rate, to Hillsdale, Mich., 101 cents and to Addison, Mich., 100 cents. Proposed, 90 cents per net ton.

13412. **Crushed stone**, carloads, Marblehead, O., to Phalanz and Warren, Ohio. Present rate, $1.20 per net ton. Proposed, 100 cents per net ton.

13431. **Crushed stone**, carloads, Melville, O., to College Corner, O., and Cottage Grove and Liberty, Ind. Present rate, 15 cents and 16½ cents per 100 lb. respectively. Proposed, 110 cents per net ton.

Illinois Freight Association Docket

974-B. **Crushed stone**, carloads, from Buffalo and Linwood, Iowa, to Hamilton, Ill. Present, class rates; proposed, $1.26 per net ton.

2775B. **Sand and gravel**, carloads, from Spring Valley, Ill. Per net ton, present: To Cherry, Ill., 88 cents; Fitchmoor, Ill., Class E; Granville, Ill., 93 cents. Proposed, to Cherry, Ill., Fitchmoor, Ill., 85 cents; Granville, Ill., 90 cents.

3242C. **Moulding sand**, carloads, from Sand Cut, Ill., to Joliet, Dwight, Pontiac and Streator, Ill. Present, combination rates. Proposed, $1.98 per net ton.

3330C. **Sand and gravel**, carloads, from Chillicothe, Ill., to Astoria, Ill. Per net ton, present, $2.20. Proposed, $1.26.

3628A. **Stone**, ground or pulverized (in bulk), carloads, from Krause, Ill., to Shattuck, Ill. Per net ton, present, $2.00. Proposed, $1.00.

3680. **Sand**, moulding, and **limestone**, carloads, from East St. Louis, Ill.

	Per net ton		
	Present	Proposed	
To—		Crushed Limestone	Moulding Sand
Springfield, Ill.	$1.00	$1.01	$2.10
Jacksonville, Ill.	1.00	1.39	2.10

3702. **Sand and gravel**, carloads, from Shawneetown, Ill., to Carrier Mills and Ledford, Ill. Per net ton. Present, $1.14. Proposed, $1.01.

3703. **Sand and gravel**, carloads, from Shawneetown, Ill., to stations on the Southern Ry., in Illinois. Per net ton:

3708. **Sand and gravel**, carloads, from Shawneetown, Ill., to stations on the Shawneetown, Ill., to stations on the Southern Ry., in Illinois. Per net ton:

To (Representative points)	Present	Proposed
Lake, Ill.	Class rates	$1.26
Albers, Ill.	Class rates	1.20
Hoffman, Ill.	Class rates	1.13
Mt. Vernon, Ill.	Class rates	1.01
Mt. Carmel, Ill.	Class rates	1.13

Southwestern Freight Bureau Docket

8496. **Lime**, from points in Arkansas to points in Kansas and Nebraska. To establish the following rates in cents per 100 lb. on lime, carloads, minimum weight 30,000 lb., from Limedale Spur and Ruddells, Ark., to points shown below:

To Mo. Pac. R. R.—Glen Rock, Neb., to Springfield, Mo., Index 790 to 860, incl., 17½; Wabash, Neb., to Lincoln, Neb., Index 870 to 900 incl., 22; Tangeman, Neb., to Carlos, Neb., Index 905 to 935, incl. 22; Sprague, Neb., Index 940, 22½; Kramer, Neb., Index 945, 24; Crete, Neb., Index 950, 25½; Topeka, Kan., to Michigan, Kan., Index 2985 to 3015, inci., 21½.

Shippers state that present rates from Ruddells and Limedale Spur, Ark., are not on proper basis as compared with rates from Springfield, Mo.

8599. **Oyster shells**, from points in Texas to Muscatine, Iowa. To establish a rate of 27 cents per 100 lb. on Oyster Shells, ground or unground in bulk, carloads, minimum weight 100,000 lb., or market capacity of car, from Houston and Rockport, Texas, to Muscatine, Iowa. Shipper states that the present rate is prohibitive.

New England Freight Association Docket

10188. To adjust the present **lime** rates from Cheshire, Farnham, North Adams, Renfrew, Richmond and Zylonite, Mass., to stations on the New York Central and West Shore R. R.'s, so that the rates will be comparable with those from Dover Plains and D. & H., lime shipping points.

10252. **Limestone**, minimum marked capacity of car, from West Stockbridge, Mass., and other lime producing points on N. Y. N. H. & H. as shown in Item 375A of N. Y. N. H. & H. I. C. C. No. F2783, to Westside Ave., Communipaw Ave., Jersey Ave., Pacific Ave., Jersey City, N. J., Communipaw, N. J., all C. R. R. of N. J. deliveries in Jersey City, N. J., 17, via N. Y. N. H. & H.-C. R. R. of N. J. Reason, to permit movement.

10289. **Stone**, broken or crushed, in bulk, in gondola or other open cars, minimum weight 90% of marked capacity of car, except when cars are loaded to cubical or visible capacity, actual weight will apply, from Trumbull, Conn., to N. Y. N. H. H. & H. R. R. stations, viz.: Bridgeport, Conn., 70 cents; Fairfield, Conn., to Westport and Saugatuck, Conn., inclusive, 75 cents, and East Norwalk, Conn., to Harlem River, N. Y., inclusive, 85 cents per ton of 2240 lb. Reason—Equalization of competitive conditions.

Southern Freight Association Docket

27149. **Lime**, from Burns, Tenn., to Erin and Palmyra, Tenn. It is proposed to extend the expiration date of the $1.10 per net ton on lime, carloads, from Burns, Tenn., to Erin and Palmyra, Tenn., as published in Supplement "D" to Agent Glenn's Lime Tariff, I. C. C. A-380, from July 1, 1926, to December 31, 1926.

27177. **Granite or stone**, rubble or crushed, from Park Hill, S. C., to Fernandina, Fla. In lieu of combination rate, it is proposed to establish on granite or stone, rubble or crushed, carloads, minimum weight 90% of marked capacity of cars, except when cars are loaded to visible capacity, actual weight will govern, from Park Hill, S. C., to Fernandina, Fla., rate of $1.76 per net ton, based on the proposed Georgia scales, less 10%.

27186. **Crushed or rubble stone**, slag, chert, sand and gravel, rates on, between stations on the Tallulah Falls Ry. and stations on various other lines. The joint scale applicable on crushed stone, etc., carloads, published by the Southern Ry. at present, applies in connection with the T. F. Ry. It is stated that the T. F. Ry. is handling this traffic at a loss. It is therefore proposed to cancel the application of So. Ry. joint line scale in connection with the T. F. Ry. and publish in lieu thereof a third scale based 20 cents per ton higher than the present rates as published in So. Ry. joint scale, such third scale to be applicable identically the same as the joint line scale at present.

27222. **Gravel**, from East St. Louis, Ill. (from beyond), to Mobile, Ala. In lieu of rate of 50½ cents per 100 lb., it is proposed to establish on gravel, minimum weight stenciled capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from East St. Louis, Ill (when from beyond) to Mobile, Ala., rate of $2.70 per net ton, based on the proposed Georgia scale extended, for the distance, disposing of the odd cents.

27236. **Sand**, from Columbia, S. C., to Port Wentworth and Savannah, Ga.-Cancellation. It is proposed to cancel present commodity rate of $1.10 per net ton on sand (other than molding), carloads, from Columbia, S. C., to Fort Wentworth and Savannah, Ga., account of no movement. Interstate mileage scale rate of $1.31 per net ton to apply after cancellation.

27245. **Crushed granite** or **stone**, from Columbia, S. C., to A. C. L. R. R. stations, viz.: Millers, Daniel, Fleming and McIntosh, Ga. It is proposed to establish reduced rate of $1.58 per net ton on granite or stone, crushed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern, from Columbia, S. C., to the destinations named, based on the carriers proposed Alabama-Georgia scale, less 10%.

27296. **Sand and gravel**, from Cantelous Spur, Ala., to B. & S. E. R. R. stations. Lowest combination now applies, and it is proposed to establish rate of $1 per net ton on sand and gravel, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Cantelous, Spur, Ala., to Birmingham and Southeastern R. R. stations between Fort Davis and Millstead, Ala., based 16 cents over rate in effect to Fort Davis, Ala.

27319. **Sand and gravel**, between A. C. L. R. R.

stations. It is proposed to establish interstate rates on sand and gravel, carloads, minimum weight 90% of marked capacity of car, between points on the A. C. L. R. R. in Alabama, Georgia, Florida and South Carolina on and north of the Jacksonville-River Junction line and south of Charleston, S. C., on scale ranging from 45 cents for five miles up to 86 cents for 50 miles, $1.08 for 100 miles, $1.31 for 150 miles, $1.44 for 200 miles, $1.67 for 300 miles, $1.89 for 400 miles, $2.12 for 500 miles and $2.25 per net ton for 560 miles. The proposed scale is the same as that submitted by carriers to the Alabama and Georgia public service commissioners for single line application over trunk lines, less 10%.

27321. **Lime**, from Sherwood, Tenn., to Delhi, La. In lieu of combination rate of $4.12 per net ton, it is proposed to establish rate of 17½ cents per 100 lb. on lime, carloads, minimum weight 30,000 lb. from Sherwood, Tenn., to Delhi, La., same as rate in effect from Chattanooga and Knoxville, Tenn.

27328. **Sand and gravel**, from Decatur, Spruce Pine, Russellville, Littleville and Goodsprings, Ala., to Florence, Sheffield and Tuscumbia, Ala. It is proposed to establish the following rates on sand and gravel, carloads, minimum weight 90% of marked capacity of car, except when loaded to visible capacity, actual weight will govern, which will result in both advances and reductions:

	In cents per net ton.		
From	Florence, To Ala.	Sheffield, Ala.	Tuscumbia, Ala.
Decatur, Ala.	79	79	81
Good Springs, Ala.	72	59	59
Littleton, Ala.	72	54	59
Russellville, Ala.	72	63	63
Spruce Pine, Ala.	72	68	68

The proposed rates from N. A. Ry. Ry. stations are made the same as rates from Gravel Sidings, Miss., but not higher than rates on basis of proposed Georgia scale, less 10%; from Decatur, Ala., on basis of the proposed Georgia scale, less 10%.

27348. **Crushed stone**, from Clermont, Ga., to Welcome, N. C. Combination basis now applicable. Proposed rate on stone, crushed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their full visible capacity, actual weight will govern, from Clermont, Ga., to Welcome, N. C., $1.92 per net ton.

27375. **Sand and gravel**, from Carrollton, Ky., to Wildie, Ky. In lieu of present rate of $1.70 per net ton, it is proposed to establish intrastate rate of $1.50 per net ton on sand and gravel, straight or mixed carloads, minimum weight 90% of marked capacity of car, except that when cars are loaded to their visible capacity, actual weight shall govern, from Carrollton to Wildie, Ky.

Western Trunk Line Docket

5398. **Lime**, carloads, from St. Genevieve, Mincke, Mosher and Byers, Mo., to various points in Iowa, Minnesota, South Dakota and North Dakota. Present, no through rates in effect; proposed, to publish through rates to points to which there is a substantial movement. For example:

From St. Genevieve, Mo.		
To—	Present	Proposed
Ames, Iowa	25	19½
Council Bluffs, Iowa	19	19
Davenport, Iowa	17	17
Minneapolis, Minn.	23	20½
Sioux Falls, S. D.	28	23½
Fargo, N. D.	33	30½

Minimum weight 30,000 lb. (By shipper.)

403D. **Lime**, carloads, from Mosher and Ste. Genevieve, Mo., to stations in Wisconsin, of which the following are representative:

To—	(1)	(2)	(3)
Appleton, Wis.	23c	23c	21c
Fond du Lac, Wis.	23c	23c	21c
Portage, Wis.	23½c	21c	.....
Stevens Point, Wis.	23½c	23½c	21c

(1) Present, minimum weight, 30,000. (2) Proposed, minimum weight, 30,000. (3) Proposed, minimum weight, 40,000.

3545-N. **Sand and gravel**, straight or mixed, carloads, from Holliday, Kan., to Argentine, Kan. Present, 3½ cents; proposed, 2½ cents. Minimum weight 90% of marked capacity of cars, except that when weight of shipment when loaded to full visible capacity of car is less than 90% of marked capacity of car, actual weight will apply. In no case shall the minimum weight be less than 40,000 lb.

4742-B. **Sand and gravel** carloads, from Millington, Ottawa, Sheridan, Wedron, Yorkville and Aurora, Ill., to Mt. Pleasant, Fairfield, Albia, Chariton, Osceola, Creston, Washington and Oskaloosa, Iowa. Present rates—As shown in tariffs. Proposed—To Mt. Pleasant, Fairfield and Washington, $1.39 per ton.

13392. (Increase.) To increase rate of 7½ to 8 cents per 100 lb. on **limestone**, agricultural, dust, ground, precipitated or pulverized carloads, minimum weight 50,000 lb., from Ogdensburg, N. J., to Kepler's Mills to Belfast, Penn., inclusive. Reason—Rates comparable with others on like commodities, from and to this same general territory.

Continue Hearing on Proposed Western Increase and Rate Structure

AT a continuation of the hearing under way before the Interstate Commerce Commission at Washington, D. C., on the rate structure investigation (ex parte 87) and the proposed 7½ cent per ton increase on crushed stone, sand and gravel, etc. (Docket No. 17000), the following testified in the interest of producers of these commodities:

John S. Burchmore, in behalf of the National Crushed Stone Association, opposed the 7½ cent per ton proposed increased rate on crushed stone. He said the increase on stone, if allowed, would result in a reduction in the tonnage. His thought was that the federal body should leave the question of rates on crushed stone, sand and gravel to the state commissions, inasmuch as 80% of that traffic was intrastate. Increases in rates, he said, would force the business from the shippers by rail to wayside pits.

B. H. Atwood, speaking for the Chicago Gravel Co. in the interest of sand and gravel, said that if the carriers would quit performing gratuitous services, particularly on high-class merchandise moving through Chicago, they could save $500,000. He said that there were at least 100 commodities in a list of 719 examined by him in connection with this case, which the cost of transferring through Chicago was so great that after the cost was paid there was nothing left for the western roads. The advance on sand and gravel, he said, was in addition to increases ranging from 15% to 45% which had taken place since the beginning of this case. The practice of the western carriers in paying the high absorptions for getting traffic through Chicago, he suggested, was not in accordance with honest, efficient and economical management. Commissioner Aitchison wanted to know where in the record there was any testimony about dishonesty. Mr. Atwood said he was not implying any dishonesty but merely quoting the terms of the statute. Among other things he mentioned as being the selling of service by the western railroads without compensation or adequate compensation was the reconsignment on citrus fruits, almost without limit.

B. L. Glover, for cement interests, said the record showed that cement paid too much in comparison with other commodities, but that cement, despite the level caused by the western scale prescribed by the commission had been moving in volume because the cement industry had carriel on a campaign in behalf of its product for use in rural construction and on highways.

In the shortened schedule time was assigned, in addition to those mentioned, to the Glencoe Lime & Cement; Mississippi Lime & Material Co.; Ste. Genevieve Lime Co.; Fayette B. Dow for the National Sand & Gravel Association, and other witnesses.

Silica Sand Rate Hearing Ended

THE hearing in docket 17817, Sub. No. 1, Illinois Silica Sand Traffic Association against the Santa Fe et al., involving rates on silica sand from points in the Ottawa, Ill., producing district to Chicago and beyond, was completed recently in Chicago before Examiner Fuller.

Edward Warsaw, on behalf of producers of silica sand in the Ottawa, Ill., district, described production conditions of the sand, telling how it was blasted, washed and screened before shipping. He also made comparisons of costs of producing the sand at different points to show that there was little difference.

R. E. Reiley, traffic manager for the Illinois Silica Sand Association, presented testimony to show that what the complainant desired was the same level of rates to the Chicago district from Ottawa and adjacent territory as common sand. He made the point that transportation conditions of silica sand and common sand were not different and that, on the basis of transportation characteristics there was no reason for placing silica sand on a higher level than common sand.

There was some argument with regard to the question of whether the complaint attacked the rates to Chicago when the sand was destined for points beyond on proportional rates. The carriers' representatives contended that they were not prepared to defend the rates beyond on the basis of proportionals.

J. C. Warsaw, of the Wedron Silica Sand Co., and R. Foster, for producers in Ottawa, testified that the plants they represented were operating only at about 40% capacity. They said that, because of the rate structure, the silica sand they produced could be used only for special purposes that required the finer grade of sand, but that, if the rates were lower, the silica sand could be shipped to be used where common sand would be used ordinarily. They testified that they desired to see the market for silica sand enlarged so that it could compete with common sand.

F. K. Crosby, for the Rock Island; G. A. Hoffelder, for the Burlington, and T. Hunter, for the Big Four, entered testimony to show that the carriers were justified in charging higher rates for the transportation of silica sand, because of its higher value as compared with common sand. The carriers' witnesses offered exhibits to show what percentage of the class rates the rates on silica sand were. The exhibits indicated that rates on silica sand were regularly about 90% of the sixth class rate, which, the carriers' representatives contended, was a fair and reasonable rate.

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Making Cut Stone Work from Concrete

Plants in Jacksonville, Fla., Have Secured a Wide Reputation for the Quality of Their Products

A CONCRETE products industry which is very well developed in Jacksonville, Fla., is that of making artificial stone and cutting it. All concrete is in a sense artificial stone, but the greater part of it cannot be cut and polished as limestone, granite, marble, and other ornamental and building stones are treated. To make a concrete which shall have the proper texture for cutting special aggregate has to be used. It must be soft, of even grain, and finely divided.

Uses Limestone Screenings

Such an industry does not offer much of an outlet for the producers of aggregate, but it is one in which limestone screenings may be used, especially if they are soft. The limestone used as aggregate in Jacksonville comes from Ocala, Fla. It is white, very soft, and for making concrete for cutting, it is crushed to about ⅛ in. and finer. The mix varies from 2½ to 1, to 3 to 1, standard portland cement being used.

The two best known concerns making this product are the Jacksonville Concrete Co. and the Arnold Stone, Brick and Tile Co. F. C. Hedrick is manager of the Jacksonville company and M. A. Arnold of the Arnold company. Both concerns do a large business in other lines of concrete work, operating tile machines and making garden furniture and the pre-cast architectural details that are so much used in Florida construction. For these products the ordinary aggregates are used; sand and gravel from Tarzan, Fla., Birmingham slag and Brooksville rock being some of them.

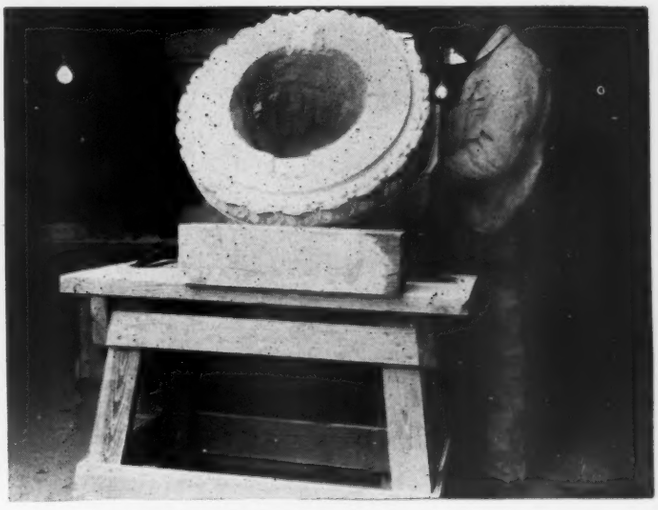
Heraldic design cut from the solid

Dry Mix Is Used

As the methods in both plants are much the same, one description will do for each. The first step is to make the mix which is not too wet and to pour it into plain molds of wood or metal of as near the size of the finished piece as is convenient. The mixture must be uniformly tamped, either by hand tampers or a compressed air tamper, or the block will not be of even texture throughout. Then the block is allowed to cure in the ordinary way.

Smooth flat surfaces are cut with a planer or shaper and circular sections may be turned in a lathe. These tools are not very different from those used in machine shops for cutting metal. One of the planers in use at

Workmen using pneumatic tools in the Arnold Brick and Tile Co. shop



Cutting an ornamented vase from a block, Jacksonville Concrete Co.

Office and yard of the Jacksonville Concrete Co. in the heart of the city

Part of the Jacksonville Concrete Co.'s storage yards and aggregate sheds

the Jacksonville plant more nearly resembles a wood planer as it has a revolving cutter. The beds and the moving parts of these machines have to be solid and heavy to avoid any danger of springing and chattering of the tool.

The shapes that are not geometric, ornamental patterns and the like are cut by hand. The workman uses an air driven chisel at the end of a hose so that it may be moved in any direction. For some finishing work the familiar round stone cutter's hammer and chisel are used.

In some cases a rough casting is made of nearly the size and shape of the finished piece and this is afterward cut to the true size and shape. But this is not so economical sometimes as cutting from the solid piece. It costs a good deal of money to make a clay model and the glue mold in which to make the rough casting so it is sometimes cheaper to let the stone cutter work out everything from a simple block.

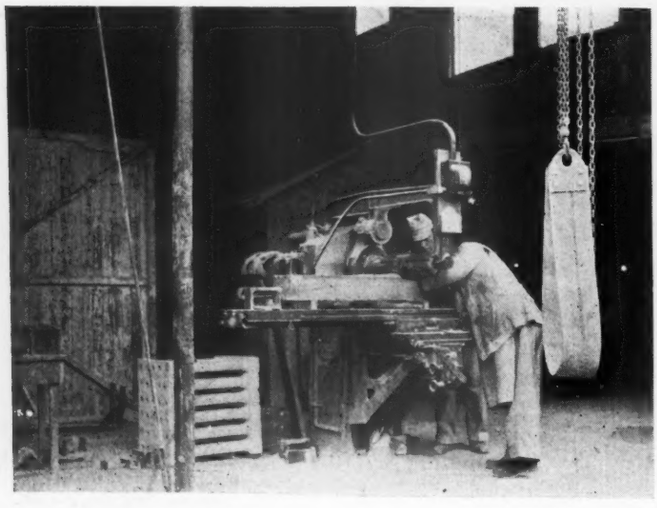
Cutting from the Block

One of the pictures shows a workman at the Jacksonville plant cutting a large vase from the block in this way, and in this instance the method was considered cheaper than casting and afterward finishing by hand.

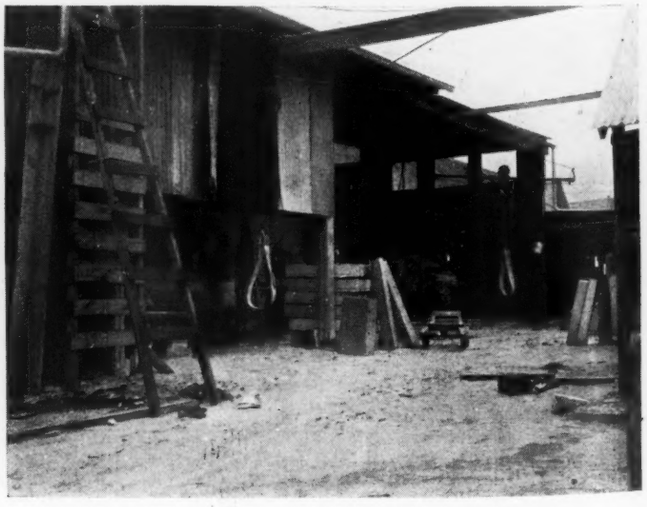
Wherever stone, either artificial or natural, is cut, a drawing has to be made for every piece, whether it be a simple ashlar of three dimensions or an elaborate piece of carving. Of course the same drawing will serve for any number of duplicate pieces, but aside from this all work has to be drawn with some care as to detail. So a force of draftsmen is maintained at each of these operations. In addition trained modellers are employed to make clay models. The expense of making this kind of concrete products is therefore high and it does not surprise one to learn that the finished product sells at about the same price as cut natural stone. It is not considered as a substitute for natural stone, or at least as a lower grade product, either by those who make it or the architects who use it. In fact many architectcs prefer it as they think it gives them somewhat greater freedom in designing.

A fine example of cutting from the Arnold shops

Cut cast stone is by no means new but the industry described here is an excellent example of the possibilities of portland cement concrete, possibilities which we are just beginning to realize. There is practically nothing that goes into building except the glass in the windows and some hardware that cannot be made of concrete today.



Blocks are worked on machine tools, such as the scraper shown here



Machine tool shed. Note the stirrups for holding ends of long pieces

Ornamental cast work, Jacksonville Concrete Co. Sometimes this is finished by hand tooling

South Florida Cement Products Manufacturers Organize

A RECENT meeting of cement products manufacturers in the Greater Miami district resulted in the organization of the Cement Products Manufacturers' Association. The purpose of the association as set forth is "to standardize the quality and strength of cement blocks used in South Florida and thereby benefit the building industry and by the improved conditions to create better understanding between the builder and his client." It was decided at the meeting that all cement blocks manufactured in the Greater Miami area in the future would be made to test at 800 lb. per sq. in., placing the product on a favorable basis with other similar building material.

Officers of the association are: G. H. Gutterman, president; R. H. Pittman, secretary; Fred Metz, treasurer; James H. Whittaker, Gorman Winston, E. H. O'Neal, M. O. Von Qualan, H. W. Pierson and C. Maxey, directors.—*Miami (Fla.) Herald.*

Whose Fault Is It?

UNDER the title, "Whose Fault Is It?" a circular issued by the Wisconsin Concrete Products Association says:

"The statement is very often made both verbally and written that concrete block buildings are damp, and we are sorry to say that even this comment is made where concrete block are used in basement construction only. You are all familiar with the quality of product that is now being made and without a doubt the absorption qualities are so much higher than they have ever been before or than other competitive building materials show, but still we find people who complain about damp basements.

"The fault usually lies in laying the block into the wall. Masons are sometimes very careless not to completely 'butter' the ends of the block, not to say anything about using a poor grade of mortar.

"Check up on your jobs and see that the mason is using sufficient mortar and good mortar. By good mortar we mean mortar composed of portland cement, sand and some lime.

"This is absolutely necessary if you are to have a watertight job.

"Of course, it is understood that the concrete block will be plastered with portland cement plaster on the outside to give the extra insurance against leakage."

Asbestos-Cement Products in Africa

THE production of asbestos cement products in the Union of South Africa has been undertaken recently. The Asbestos-Cement Manufacturing Co. at Wentworth obtains practically all of its raw material from South Africa, and more recently a factory in the Transvaal has turned out a variety of concrete and asbestos cement products, particularly asbestos-cement sheets. Owing to the competition with foreign manufactures—principally those of Great Britain, Belgium, the Netherlands and the United States—both concerns are operating on the basis of a restricted output notwithstanding a protective tariff.

Ornamental Cast Stone Plant Increases Capacity

TO provide for the increased demand for its products, the Houston Art Stone Co., Houston, Tex., is erecting a new plant, which when completed will afford facilities for more than doubling the present output of cast stone and ornamental plaster. The new plant, a 2-story concrete building, 70x32 ft., is under construction near the old one. Upon completion the business will be removed there, while the walls of the old plant will be raised to 2-story height, the building remodeled and then connected with the new section. With the installation of pneumatic tampers it is expected that the production will be raised to about 1000 pieces of stone per day.

The Houston Art Stone Co. was started in 1914 by C. Marini, the present owner, and was the first company to introduce cement cast stone in Houston. At that time Mr. Marini employed but two men, but the business has grown to such an extent that with the completion of the new plant between 35 and 40 men, engaged as modelers, mold makers, casters, are necessary.—*Houston (Tex.) Chronicle.*

Scheme Which Sold Fence Posts

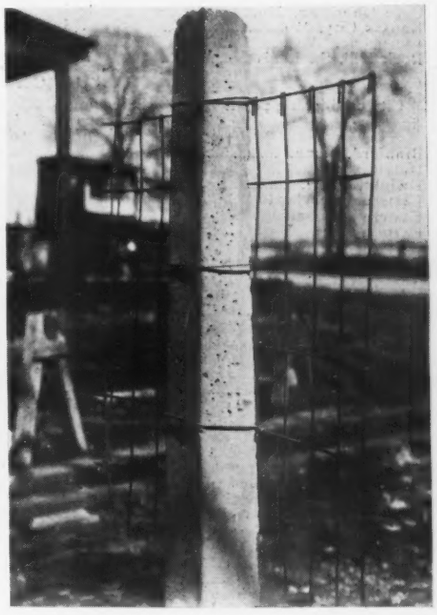
F. L. MILLER, manager of the Nelsen Concrete Culvert Co., of Hattiesburg, Miss., has worked up quite a trade in concrete fence posts and he did it by putting the post and bit of fencing shown in the cut in front of his office where everyone who passed might see it.

We are so prone to think along the lines of familiar ways of doing things that the ordinary man could think of no other way of fastening a wire to a fence post than of driving a staple. Mr. Miller found when he tried to sell a man fence posts, that the first question asked was how it was possible to drive a staple into concrete.

The answer, of course, is that it isn't posisible but that a better and stronger fastening can be made by wrapping a short piece of wire around the post and turning the ends over the fence wire two or three turns with the pliers.

Since the post has been set up it has been a "silent salesman" and people driving by have often had enough curiosity to stop and examine it.

The making of concrete fence posts is a simple matter and in localities even where wood is plentiful they can be sold on account of their permanancy and good appearance.



Showing how the fence was fastened to the post made many sales

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Chaumont, N. Y.	.50	.....	1.75	1.50	1.50	1.50
Chazy, N. Y.	.75	1.65	1.65	1.40	1.40	1.40
Cobleskill, N. Y.	1.50	1.35	1.25	1.25	1.25	.....
Dundas, Ont.	.53	1.05	1.05	.90	.90	.90
Eastern Pennsylvania	1.35	1.35	1.35	1.35	1.35	1.35
Frederick, Md.	.50@ .75	1.25@1.35	1.20@1.30	1.10@1.20	1.05@1.10	1.05@1.10
Munns, N. Y.	1.00	1.50	1.50	1.40	1.25	.....
Northern New Jersey	1.60	1.50@1.80	1.30@2.00	1.40@1.60	1.40@1.60	.....
Prospect, N. Y.	1.00	1.50	1.40	1.30	1.30	.....
Walford, Penn.	.70	1.35	1.35	1.35	1.35	1.50
Watertown, N. Y.	.50	.....	1.75	1.50	1.50	1.50
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL						
Afton, Mich.	.....	.....	.50	.....	.....	1.50
Alton, Ill.	1.85	.....	1.85	.....	.....	.....
Bloomville, Middlepoint, Dunkirk, Bellevue, Waterville, No. Baltimore, Holland, Kenton, New Paris, Ohio; Monroe, Mich.; Huntington, Bluffton, Ind.	1.00	1.10	1.10	1.00	1.00	1.00
Buffalo and Linwood, Iowa	1.10	.....	1.10	.90	.95	.95
Chasco, Ill.	1.25	.....	.....	.....	.....	1.15
Columbia and Krause, Ill.	1.00@1.50	.90@1.10	1.20@1.35	1.00@1.20	.90@1.20	.....
			Flux 1.50@1.75			
Cypress, Ill.	1.15	1.15	1.15	1.15	1.05	1.00
Greencastle, Ind.	1.25	1.25	1.15	1.05	.95	.95
Lannon, Wis.	.80	1.00	1.00	.90	.90	.90
Milltown, Ind.	.....	.90@1.00	.75@ .85	.90@1.00	.85@ .90	.85
Northern New Jersey	1.30	.....	1.80	1.60	1.40	.....
River Rouge, Mich.	1.10	1.10	1.10	1.10	1.10	1.10
St. Vincent de Paul, Que.	.75	1.25	1.00	.90	.85	1.00
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	.....
Toledo, Ohio	1.60	1.70	1.70	1.60	1.60	1.60
Stone City, Iowa	.75	.....	†1.10	1.05	1.00	.....
Waukesha, Wis.	.90	.90	.90	.90	.90	.90
SOUTHERN:						
Alderson, W. Va.	.60	1.45	1.35	1.25	1.20	1.15
Allgood, Ala.			Crusher run, fines out, for flux, 1.00 per net ton			
Cartersville, Ga.	1.00	1.50	1.50	1.15	1.15	.....
Chico, Texas	1.00	1.35	1.30	1.25	1.15	1.10
El Paso, Tex.	1.00	1.00	1.00	1.00	.....	.....
Ft. Springs, W. Va.	.50	1.60	1.50	1.35	1.25	.....
Graystone, Ala.			Crusher run fluxing stone, 1.00 per net ton			
Henderson, N. C.	.....	.....	1.50	.....	1.25	.....
McCook, Ill.	1.00	1.25	1.25	1.25	1.25	1.25
New Braunfels, Tex.	.30@1.00	1.00@1.30	1.00@1.30	.70@1.00	.70@ .90	.....
Olive Hill, Ky.	.50@1.00‡	1.00	1.00	1.00	1.00	1.00
Rocky Point, Va.	.50@1.00	1.40@1.60	1.30@1.40	1.15@1.35	1.10@1.20	1.00@1.05
WESTERN:						
Atchison, Kans.	.25	2.00	2.00	2.00	2.00	1.80
Blue Springs & Wymore, Neb.	.25	1.45	1.45	1.35c	1.25d	1.20
Cape Girardeau, Mo.	1.25	1.25	1.25	1.25	1.10	.....
Kansas City, Mo.	.75	1.50	1.50	1.50	1.50	1.50
Limestone, Wash.	3.00	3.00	3.00	3.00	3.00	3.00
Rock Hill, St. Louis Co., Mo.	1.30	1.15	1.15	1.15	1.15	1.30

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.80	1.70	1.45	1.20	1.05	.....
Duluth, Minn.	.90	2.25	1.90	1.50	1.35	1.35
Dwight, Calif.	1.00	1.00	1.00	.90	.90	.....
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Texas	2.50	1.25	1.55	1.35	1.25	.....
New Haven, New Britain, Meriden & Wallingford, Conn.	.80	1.70	1.45	1.20	1.05	1.05
Northern New Jersey	1.50	2.00	1.80	1.40	1.40	.....
Oakland and El Cerritto, Cal.	1.00	1.00	1.00	.90	.90	.....
San Diego, Calif.	.....	2.75	2.55	2.35	2.35	.....
Sheboygan, Wis.	1.00	1.10	1.10	1.10	1.10	.....
Springfield, N. J.	1.60	2.00	1.90	1.60	1.60	.....
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	.....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Berlin, Utley, Montello and Red Granite, Wis.—Granite	1.80	1.70	1.50	1.40	1.40	.....
Coldwater, N. Y.—Dolomite			1.50 all sizes			
Columbia, S. C.—Granite	.....	.....	1.75	.....	1.50	.....
Eastern Penn.—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Havelock, Ontario	.....	2.60	2.10	2.10	.....	.....
Lithonia, Ga.	.75a	2.00	1.60	1.35	1.30	1.25
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	.....
Middlebrook, Mo.—Granite	3.00@3.50	.....	2.00@2.25	2.00@2.25	.....	1.25@2.00
Northern New Jersey (Basalt)	1.50	2.00	1.80	1.40	1.40	.....
Richmond, Calif.—Quartzite	.75	.....	1.00	1.00	1.00	.....
Somerset, Pa. (sand-rock)	1.85@2.00a	.....	1.35@1.50	.....	1.00@1.50	.....
Toccoa, Ga.—Granite	1.50	1.40	1.35	1.30	1.30	1.30

*Cubic yd. †1 in. and less. ‡Two grades. ‖Rip rap per ton. (a) Sand. (b) to ¾ in. (c) 1 in., 1.40. (d) 2 in., 1.30. (e) Dust. (f) ¾ in. (h) less 10c discount. (i) 1 in., 1.40.

Agricultural Limestone

(Pulverized)

Alderson, W. Va.—50% thru 50 mesh	1.50
Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 90% thru 100 mesh	6.00
Asheville, N. C.—Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; 200-lb. burlap bag, 4.00; bulk	2.75
Atlas, Ky.—90% thru 100 mesh	2.00
50% thru 100 mesh	1.00
Belfast and Rockland, Me. (rail), Lincolnville, Me. (water), analysis $CaCO_3$ 90.04%; $MgCO_3$ 1.5%, 100% thru 14 mesh, bags	4.50
Bulk	3.50
Branchton and Osborne, Penn.—100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh. (Less 50 cents commission to dealers)	5.00
Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$; pulverized; 50% thru 50 mesh	1.50
Cartersville, Ga.—Pulverized, 2.25; 50% thru 50 mesh	1.50
Chaumont, N. Y.—Pulverized limestone, bags, 4.00; bulk	2.50
Chico, Texas.—50% thru 50 mesh, bulk	1.75
Colton, Calif.—Analysis 90% $CaCO_3$, bulk	4.00
Cypress, Ill.—90% thru 100 mesh	1.35
Henderson, N. C. (paving dust)—80% thru 200 mesh, bags	4.25@ 4.75
Bulk	3.00@ 3.50
Analysis $CaCO_3$, 56%; $MgCO_3$, 42%; 65% thru 200 mesh, bags	3.95
Bulk	2.70
Hillsville, Penn.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$; 75% thru 100 mesh; sacked	5.00
Jamesville, N. Y.—Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; pulverized, bags, 4.00; bulk	2.50
Joliet, Ill.—85% thru 200 mesh	4.25
Knoxville, Tenn.—Analysis, 52% $CaCO_3$, 37% $MgCO_3$; 80% thru 100 mesh; bags, 3.75; bulk	2.50
Marblehead, Ohio—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; 80 lb. paper sacks, 5.00; bulk	3.50
Marion, Va.—Analysis, 90% $CaCO_3$, pulverized, per ton	2.00
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 90% thru 100 mesh	3.90@ 4.50
Milltown, Ind.—Analysis, 94.50% $CaCO_3$, 33% thru 50 mesh, 40% thru 50 mesh; bulk	1.35@ 1.60
Olive Hill, Ky.—50% thru 50 mesh, 2.00; 90% thru 4 mesh	1.00
Piqua, Ohio—Total neutralizing power 95.3%; 99% thru 10, 60% thru 50; 50% thru 100	2.50@ 2.75
100% thru 10, 90% thru 50, 80% thru 100; bags, 5.10; bulk	3.60
99% thru 100, 85% thru 200; bags, 7.00; bulk	5.50
Rocky Point, Va.—Analysis 99.5% $CaCO_3$, 0.25% $MgCO_3$; 50% thru 200 mesh; bags, 3.25@3.50; bulk	2.00
Toledo, Ohio, 30% through 50 mesh	2.25
Waukesha, Wis.—90% thru 100 mesh, 4.50; 50% thru 100 mesh, 2.10; 90% thru 50 mesh	1.65
Watertown, N. Y.—Analysis, 96-99% $CaCO_3$; 50% thru 100 mesh; bags, 4.00; bulk	2.50
West Stockbridge, Mass.—Analysis 90% $CaCO_3$, 50% thru 100 mesh; cloth bags, 4.75; paper, 4.25; bulk	3.25

Agricultural Limestone

(Crushed)

Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 50% thru 4 mesh	3.00
Atlas, Ky.—50% thru 4 mesh	.50
Bedford, Ind.—Analysis, 98.5% $CaCO_3$, 0.5% $MgCO_3$; 90% thru 10 mesh	1.50
Blackwater, Mo.—Analysis, 99% $CaCO_3$; 90% thru 4 mesh	.75
Bridgeport and Chico, Texas—Analysis, 94% $CaCO_3$, 2% $MgCO_3$; 100% thru 10 mesh	1.75
50% thru 4 mesh	1.50
Chasco, Ill.—50% thru 100 mesh	1.20
Chico, Texas—50% thru 4 mesh; bulk	1.50

(Continued on next page)

Agricultural Limestone

Chicago, Ill.—50% thru 100 mesh; 90% thru 4 mesh	.80
Columbia, Krause, Valmeyer, Ill.—Analysis, 90% $CaCO_3$; 90% thru 4 mesh	1.35
Cypress, Ill.—90% thru 50 mesh, 50% thru 100 mesh, 90% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh	1.35
Dundas, Ont.—Analysis, 53.8% $CaCO_3$; $MgCO_3$, 43.3%. 50% thru 50 mesh; bags, $4.75; bulk	3.00
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh	1.50
Garnet, Okla.—All sizes	1.25
McCook, Ill.—Analysis, approx. 60% $CaCO_3$, 40% $MgCO_3$; 90% thru 4 mesh	.90
Kansas City, Mo.—50% thru 100 mesh	.75
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% through 10 mesh; 46% through 60 mesh	2.00
Screenings (¼ in. to dust)	1.00
Marblehead, Ohio.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$, 32% thru 100 mesh; 51% thru 50 mesh; 83% thru 10 mesh; 100% thru 4 mesh (meal) bulk	1.60
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 50% thru 50 mesh	1.85@ 2.35
Middlepoint, Bellevue, Kenton, Ohio; Monroe, Mich.; Huntington and Bluffton, Ind.—Analysis, 42% $CaCO_3$, 54% $MgCO_3$; meal, 25 to 45% thru 100 mesh	1.60
Moline, Ill., and Bettendorf, Iowa—Analysis, 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh	1.50
Mountville, Va.—Analysis, 62.54% $CaCO_3$; $MgCO_3$, 35.94%, 100% thru 20 mesh	5.50
Pixley, Mo.—Analysis, 96% $CaCO_3$; 50% thru 50 mesh	1.25
50% thru 100 mesh; 90% thru 50 mesh; 50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh	1.65
River Rouge, Mich.—Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk	.80@ 1.40
Stone City, Iowa.—Analysis, 98% $CaCO_3$; 50% thru 50 mesh	.75
Tulsa, Okla.—Analysis $CaCO_3$, 86.15%, 1.25% $MgCO_3$, all sizes	1.25

Pulverized Limestone for Coal Operators

Hillsville, Penn., sacks, 4.50; bulk	3.00
Joliet, Ill.—85% thru 200 mesh	4.25
Piqua, Ohio, sacks, 4.50@5.00 bulk	3.00@ 3.50
Rocky Point, Va.—80% thru 200 mesh; bags, 4.25@4.75; bulk	3.00@ 3.50
Waukesha, Wis.—90% thru 100 mesh, bulk	4.50

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

Berkeley Springs, W.Va.—Glass sand	2.25
Cedarville and S. Vineland, N. J.—Damp	1.75
Dry	2.25
Cheshire, Mass.: 6.00 to 7.00 per ton; bbl	2.50
Columbus, Ohio	1.00@ 1.25
Estill Springs and Sewanee, Tenn.	1.50
Franklin, Penn.	2.00
Gray Summit and Klondike, Mo.	2.00
Los Angeles, Calif.—Washed	5.00
Mapleton Depot, Penn.	2.00@ 2.25
Massillon, Ohio	3.00
Mineral Ridge and Ohlton, Ohio.	2.50
Oceanside, Calif.	3.00
Ottawa, Ill.	.75@ 1.25
Pittsburgh, Penn.—Dry	4.00
Damp	3.00
Red Wing, Minn.: Bank run	1.50
Ridgway, Penn.	2.50
Rockwood, Mich.	2.75@ 3.25
Round Top, Md.	2.25
San Francisco, Calif.	4.00@ 5.00
St. Louis, Mo.	2.00
Sewanee, Tenn.	1.50
Thayers, Penn.	2.50
Utica, Ill.	1.00@ 1.25
Zanesville, Ohio	2.50

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio		1.75
Columbus, Ohio		.30@ .80
Eau Claire, Wis.	4.25	*.40@ 1.00
Estill Springs and Sewanee, Tenn.	1.35@ 1.50	1.35@ 1.50

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in and less
EASTERN:						
Ambridge & So. H'g'ts, Penn.	1.25	1.25	1.15	.85	.85	.85
Attica and Franklinville, N. Y.	.75@ .85	.75	.85	.75	.75	.75
Boston, Mass.‡	1.40	1.40	2.25		2.25	2.25
Buffalo, N. Y.	1.10	.95			.85	
Erie, Pa.		1.00*		1.50*	1.75*	
Farmingdale, N. J.	.58	.48	.75	1.20	1.10	
Hartford, Conn.	.65*					
Leeds Junction, Me.		.50	1.75		1.35	1.25
Machias Jct., N. Y.		.75	.75		.75	
Montoursville, Penn.	1.00	1.00	.90	.75	.75	.75
Northern New Jersey	.40@ .50		1.25		1.25	
Olean, N. Y.		.75	.75		.75	
Shining Point, Penn.			1.00	1.00	1.00	1.00
Somerset, Pa.		1.85@2.00		1.35@1.50		
South Heights, Penn.	1.25	1.25	.85	.85	.85	.85
Washington, D. C.	.85	.85	1.70	1.50	1.30	1.30
CENTRAL:						
Algonquin and Beloit, Wis.	.50	.40	.60	.60	.60	.60
Attica, Ind.			All sizes .75@.85			
Aurora, Oregon, Sheridan, Moronts, Yorkville, Ill.	.40@ .50	.40@ .60	.20@ .50	.50@ .60	.60	.55@ .60
Barton, Wis.		.50		.70	.70	.70
Chicago, Ill.	.70	.60	.50	.60	.60	.60
Columbus, Ohio		.70	.70	.70	.70	
Des Moines, Iowa	.40	.40	1.50	1.50	1.50	1.50
Eau Claire, Wis.	.40	.45	.95	1.00	.95	.95
Elgin, Ill.		.20*	.50*	1.50*	1.50*	1.50*
Elkhart Lake, Wis.	.60	.30	.50	.50	.40	.40
Ferrysburg, Mich.		.50@ .80	.60@1.00	.60@1.00		.50@1.25
Ft. Dodge, Iowa	.85	.85	2.05	2.05	2.05	2.05
Ft. Worth, Texas	2.00	2.00	2.00	2.00	2.00	2.00
Grand Haven, Mich.		.50@ .80		.60@ .90		.70@ .90
Grand Rapids, Mich.		.50		.80	.80	.70
Hamilton, Ohio		1.00			1.00	
Hersey, Mich.		.50				.70
Humboldt, Iowa	.40@ .60	.40@ .60	1.40@1.60	1.40@1.60	1.40@1.60	1.40@1.60
Indianapolis, Ind.	.60	.60		.90	.75@1.00	.75@1.00
Joliet, Plainfield and Hammond, Ill.	.60	.50	.50	.60	.60	.60
Mason City, Iowa	.50	.50	1.45	1.45	1.45	1.35
Mankato, Minn.		.45	1.25	1.25	1.25	1.25
Mattoon, Ill.	.75	.75	.75	.75	.75	.75
Milwaukee, Wis.		1.01	1.21	1.21	1.21	1.21
Moline, Ill.	.60@ .85	.60@ .85	1.00@1.20	1.00@1.20	1.00@1.20	1.00@1.20
Northern New Jersey	.70	.70			1.60	
Oregon City, Ore.		1.25	1.25	1.25	1.25	1.25
Palestine, Ill.	.75	.75	.75	.75	.75	.75
Silverwood, Ind.	.75	.75	.75	.75	.75	.75
St. Louis, Mo.	1.18	1.45	1.65	1.45	1.65	1.45c
Terre Haute, Ind.	.75	.60	.75	.90	.90	.75
Wolcottville, Ind.	.75	.75	.75	.75	.75	.75
Waukesha, Wis.		.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	1.50	1.25	1.10	1.10
Zanesville, Ohio		.60	.50	.60	.80	
SOUTHERN:						
Charleston, W. Va.		All sand, 1.40.		All gravel, 1.50.		
Chattanooga, Tenn.		1.65			1.45	
Knoxville, Tenn.	1.00	1.00	1.20	1.20	1.20	1.20
Lindsay, Texas					.55	
Macon, Ga.		.50				
New Martinsville, W. Va.	1.00	.90@1.00		1.20@1.30		.80@ .90
Roseland, La.	.60	.50	1.50	1.10	1.10	
WESTERN:						
Kansas City, Mo.	1.00	.70				
Los Angeles, Calif. (points all around) (d)	.60	.50	.85	.85	.85	.85
Los Angeles district (bunkers)†	1.50	1.40	1.85	1.85	1.85	1.85
Phoenix, Ariz.	1.25*	1.00*	2.50*	2.00*	1.75*	1.50*
Pueblo, Colo.	.80	.65		1.35		1.20
San Diego, Calif.	.65@ .75	.65@ .75	1.50	1.30	1.10	1.10
Seattle, Wash. (bunkers)	1.50*	1.50*	1.50*	1.50*	1.50*	1.50*

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Algonquin and Beloit, Wis.			Dust to 3 in., .40			
Chicago, Ill.						.40
Dudley, Ky.	1.10	1.00	.90			
East Hartford, Conn.			Sand, .75*			
Ferrysburg, Mich.						.65@1.00
Gainesville, Texas		.95				.55
Grand Rapids, Mich.				.60		
Hamilton, Ohio					.70	
Hersey, Mich.				.50		
Indianapolis, Ind.			Mixed gravel for concrete work, at .65			
Joliet, Plainfield and Hammond, Ill.	.35					
Lindsay, Texas						.55
Macon, Ga.	.35	.35				
Mankato, Minn.			Pit run sand, .70			
Moline, Ill. (b)	.60	.60	Concrete gravel, 50% G., 50% S., 1.00			
Ottawa, Oregon, Moronts and Yorkville, Ill.			Ave. .60 per ton all sizes			
Roseland, La.					.85	
St. Louis, Mo.			Mine run gravel, 1.55 per ton			
Shining Point, Penn.			Concrete sand, 1.10 ton			
Smithville, Texas	.50	.50	.50	.50	.50	.54
Summit Grove, Ind.	.50	.50	.50	.50	.50	.54
Waukesha, Wis.	.60	.60	.60	.60	.60	.64
Winona, Minn.	.40	.40	.60	.60	.60	.60
York, Penn.	1.10	1.00				

(a) ¾ in. down. (b) River run. (c) 2½ in. and less.
*Cubic yd. †Include freight and bunkerage charges and truck haul. ‡Delivered on job.
(d) Less 10c per ton if paid E.O.M. 10 days. (e) pit run. (f) plus 15c winter loading charge.

Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

City or shipping point	Molding, fine	Molding, coarse	Molding, brass	Core	Furnace lining	Sand blast	Stone sawing
Aetna, Ill.				.30@ .35			
Albany, N. Y.	2.25	2.00	2.25			3.50	
Arenzville, Ill.	1.50@1.75			1.00			
Beach City, Ohio	1.75@2.25	1.75@2.25		1.75@2.25	2.00@2.50	2.00@2.50	
Columbus, Ohio	1.50@2.00	1.25@1.75	2.00@2.50	.30@1.00	2.00@2.50	3.50@4.00	1.25@1.50
Eau Claire, Wis.				1.25		3.00	
Elco, Ill.	Ground silica per ton in carloads—18.00@31.00						
Elnora, N. Y.			1.75				
Estill Springs and Sewanee, Tenn.	1.25			1.25		1.35@1.50	
Franklin, Penn.	1.75	1.75		1.75			
Joliet, Ill.	No. 2 molding sand; loam for luting and open hearth work—.65@.85						
Kasota, Minn.							1.00@1.25
Klondike, Mo.	1.75		2.00	1.75	1.75		1.25
Mapleton Depot, Penn.	2.00	2.00	2.00	2.00		2.25	
Massillon, Ohio	2.50	2.50		2.50	2.50		
Michigan City, Ind.				.30@ .35			
Mineral Ridge and Ohlton, Ohio	1.75*	1.75*		2.00*	1.75*	2.00*	1.75*
Montoursville, P'n.				1.25@1.35			
New Lexington, O.	1.75	1.25					
Ottawa, Ill.				.75@2.50		3.50	3.00
Red Wing, Minn.	1.25		1.25	1.50	1.50	3.50	1.50
Ridgeway, Penn.	1.50	1.50					
Round Top, Md.				1.60			
San Francisco, Calif.	3.50	4.75	3.50	3.50@5.00	3.50@4.50	3.50@5.00	
Tamalco, Ill.		1.40@1.60					
Tamms, Ill.	Ground silica per ton in carloads—20.00@31.00						
Thavers, Penn.	1.25	1.25		2.00			
Utica, Ill.	.60	.65		.75	.75		
Utica, Penn.	1.75	1.75		2.00			
Warwick, Ohio	1.75*@2.25	1.75*		1.75*@2.25			
Zanesville, Ohio	1.75	1.25@1.50	1.75				

*Green. †Crude silica, crushed and screened, not washed or dried. ‡Plus 75c per ton for winter loading. ¶Crude. §Crude and dry.

Crushed Slag

City or shipping point EASTERN:	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in and less	2½ in. and less	3 in. and larger
Buffalo, N. Y., Emporium nd Dubois, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Eastern Penn. and Northern N. J.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Reading, Pa.	2.50	1.00		1.25			
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	2.05*	1.45*	1.80*	1.45*	1.45*	1.45*	1.45*
Jackson, Ohio		1.05*		1.30*	1.05*	1.30*	1.30*
Toledo, Ohio	1.50	1.25	1.50	1.25	1.25	1.25	1.25
Youngst'n, O., dist.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.		1.55*		1.55*	1.55*	1.55*	1.55*
Ensley and Alabama City, Ala.	2.05	.80	1.35	1.25	.90	.90	.80
Longdale, Roanoke, Ruessens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
Woodward and East Birmingham, Ala.	2.05	.75		1.25	.90@1.05	.90	

*5c per ton discount on terms.

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.			12.00					2.20
Buffalo, N. Y.		12.00	12.00	12.00			10.00	1.95d
Chazy, N. Y.	12.50	10.50	8.00	12.00	11.50	16.50	10.00	2.50z
Lime Ridge, Penn.							5.00a	
West Stockbridge, Mass.	12.00	10.00	5.60					2.00t
Williamsport, Penn.			10.00				6.00	
York, Penn.		9.50	9.50	10.50			8.50	1.65i
CENTRAL:								
Afton, Mich.					8.50	1.61		
Carey, Ohio	12.50	8.50@9.50	9.50		9.50		9.00	
Cold Springs, Ohio	12.50	8.50	8.50		9.00		8.00	
Delaware, Ohio	12.50	10.00	9.00	10.00			9.00	1.50
Frederick, Md.		9.50	9.50	9.50	8.00	9.50	7.50	1.45e
Gibsonburg, Ohio	12.50							
Huntington, Ind.	12.50	8.50	8.50		9.00		8.00	
Luckey, Ohio (f)	12.50							
Marblehead, Ohio		8.50	8.50		9.00		8.00	1.50w
Marion, Ohio		8.50	.850				8.00	1.70d
Milltown, Ind.		9.00@10.00		10.00p	8.00s			1.40r
Sheboygan, Wis.	11.50						9.50	.95
Tiffin, Ohio					9.00			
White Rock, Ohio	12.50				9.00	11.00	8.00	
Wisconsin points (f)		11.50					9.50	
Woodville, Ohio	12.50	8.00	8.00	13.50	9.00	11.00	9.00	1.50
SOUTHERN:								
Allgood, Ala.	12.50	10.00			8.50		8.50	1.50
El Paso, Tex.							14.00	1.75
Graystone, Ala.	12.50	10.00		12.50			8.50	1.50
Keystone, Ala.	12.50	10.00	10.00	10.00			8.50	1.50u
Knoxville, Tenn.	20.25	10.00		10.00			8.50	1.50
Ocala, Fla.		13.50	10.00				12.50	1.70
WESTERN:								
Calcite, Colo.							9.25	
Kirtland, N. M.							15.00	
Limestone, Wash.	15.00	15.00	10.00	15.00	16.50	16.50	16.50	2.09
Dittlinger, Tex.		12.00@13.00					9.50p	1.50x
San Francisco, Calif.	19.50@21.00	18.00@20.00	15.00	18.50			14.00s	2.00
Tehachapi, Calif.			8.00				13.00z	2.20x
Seattle, Wash.	19.00	19.00	12.00	19.00	19.00		18.60	2.30

†50-lb. paper bags; (a) run of kilns; (c) wooden, steel 1.70; (d) steel; (e) per 180-lb. barrel; (f) dealers' prices; (g) to 9.50; (h) to 1.75; (i) 180-lb. net barrel 1.65; 280-lb. net barrel, 2.65 (m) finishing lime, 3.00 common; (n) common lime; (o) high calcium; (p) to 10.50; (q) to 8.50; (r) to 1.50; (s) in 80-lb. burlap sacks; (t) to 3.00; (u) two 90-lb. bags; (v) oil burnt; wood burnt 2.25@2.50; (x) wood, steel 2.30; (z) to 15.00; (*) quoted f.o.b. New York; (‡) paper bags; (w) to 1.50 in two 90-lb. bags, wood bbl. 1.60; (1) to 10.00; (2) 80-lb. paper bags; (3) to 3.00; (4) to 9.00; (5) to 1.60. (6) to 16.00.

Miscellaneous Sands

(Continued)

City or shipping point	Roofing sand	Traction
Gray Summit and Klondike, Mo.		1.75
Mapleton Depot, Penn.	2.00	2.00
Massillon, Ohio		2.25
Mineral Ridge and Ohlton, Ohio	*1.75	*1.75
Montoursville, Penn.		1.25
Ottawa, Ill.	1.00@ 1.50	
Red Wing, Minn.		1.25
Round Top, Md.	2.25	1.75
San Francisco, Calif.	3.50@ 4.50	3.50@ 4.50
Thayers, Penn.		2.25
Utica, Ill.	1.00@ 1.25	1.00
Warwick, Ohio		2.25
Zanesville, Ohio		2.50

*Wet.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point,

Baltimore, Md.:	
Crude talc (mine run)	3.00@ 4.00
Ground talc (20-50 mesh), bags	10.00
Cubes	55.00
Blanks (per lb.)	.08
Pencils and steel worker's crayons, per gross	.08 1.25
Chatsworth, Ga.:	
Crude Talc	5.00
Ground (150-200 mesh), bulk	12.00
Pencils and steel worker's crayons, per gross	1.00@ 2.50
Chester, Vt.:	
Ground talc (150-200 mesh), bulk	9.00@10.00
Including bags	10.00@11.00
Chicago and Joliet, Ill.:	
Ground (150-200 mesh), bags	30.00
Dalton, Ga.:	
Crude talc	5.00
Ground talc (150-200) bags	10.00@12.00
Pencils and steel workers' crayons, per gross	1.00@ 1.50
Emeryville, N. Y.:	
(Double air floated) including bags;	
325 mesh	14.75
200 mesh	13.75
Hailesboro, N. Y.:	
Ground white talc (double and triple air floated) including bags, 300-350 mesh	15.50@20.00
Henry, Va.:	
Crude (mine run)	3.50@ 4.50
Ground talc (150-200 mesh), bulk	8.75@16.00
Joliet, Ill.:	
Roofing talc, bags	12.00
Ground talc (200 mesh), bags	30.00
Keeler, Calif.:	
Ground (200-300 mesh), bags	20.00@30.00
Natural Bridge, N. Y.:	
Ground talc (300 mesh), bags	13.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 65-70%..	4.50@ 5.00
Mt. Pleasant, Tenn.—B.P.L. 75%.....	5.50@ 6.00
Tennessee—F.O.B. mines, gross ton, unground brown rock, B.P.L. 72%	5.00
B.P.L. 75%	6.00
Twomey, Tenn.—B.P.L. 65%, 2000 lb.	7.25@ 8.25

Ground Rock

(2000 lbs.)

Centerville, Tenn.—B.P.L. 65%	7.00
Gordonsburg, Tenn.—B.P.L. 65-70%..	4.00@ 4.50
Mt. Pleastnt, Tenn.—B.P.L. 65%.....	7.25@ 9.25
Twomey, Tenn.—B.P.L. 65%.....	8.00@ 9.00

Florida Phosphate

(Raw Land Pebble)

(Per Ton.)

Florida—F. O. B. mines, gross ton,	
68/66% B.P.L., Basis 68%.....	3.25
70% min. B.P.L., Basis 70%.....	3.75
72% min. B.P.L., Basis 72%.....	4.25
75/74% B.P.L., Basis 75%.....	5.25
77/76% B.P.L., Basis 77%.....	6.25

Mica

Prices given are net, F.O.B. plant or nearest shipping point.

Pringle, S. D.—Mine run, per ton	125.00@150.00
Punch mica, per lb.	.06
Scrap, per ton, carloads	20.00
Rumney Depot, N. H. — per ton,	
mine run	360.00
Mine scrap	24.00
Clean shop scrap	27.00
Dry ground, 20 mesh	28.00
40 mesh	35.00
60 mesh	40.00
100 mesh	60.00
200 mesh	80.00
Roofing mica	27.00
Punch mica, per lb.	.10

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Barton, Wis., f.o.b. cars	.....	10.50
Brandon, Vt.—English pink and English cream	*11.00	*11.00
Brandon grey	*11.00	*11.00
Brighton, Tenn.—Pink	.....	†6.00
Buckingham, Que.—Buff stucco dash	.....	‡12.00@14.00
Chicago, Ill. — Stucco chips, in sacks f.o.b. quarries	.....	17.50
Crown Point, N. Y.—Mica Spar	.....	8.00@10.00
Easton, Penn.—Green, bags included	10.00@20.00	10.00@20.00
Haddam, Conn. — Felstone buff	15.00	15.00
Harrisonburg, Va.—Bulk marble (crushed, in bags)	†12.50	†12.50
Ingomar, Ohio — Concrete facings and stucco dash	.....	6.00@16.00
Middlebrook, Mo.—Red	.....	20.00@25.00
Middlebury and Brandon, Vt.—Middlebury white	.....	‡9.00
Milwaukee, Wis.	.....	14.00@34.00
Newark, N. J.—Roofing granules	.....	7.50
New York, N. Y.—Red and yellow Verona	.....	32.00
Red Granite, Wis.	.....	7.50
Sioux Falls, S. D.	7.50	7.50
Stockton, Calif. — "Natrock" roofing grits	.....	15.00@20.00
Tuckahoe, N. Y.	.....	12.00
Villa Grove, Colo.	.....	13.00
Warren, N. H.—cement facing (mica), per ton	.....	7.50
Wauwatosa, Wis.	.....	16.00@45.00
Wellsville, Colo.—Colorado Travertine Stone	15.00	15.00

†C.L.
*C.L. including bags; L.C.L. 12.50.
‡C.L. including bags, L.C.L. 10.00.

Potash Feldspar

Auburn and Brunswick, Me.—Color, white; 98% thru 140 mesh bulk	19.00
Bath, Me.—Color, white; analysis, potash, 12%; 100% thru 180 mesh, bags, 21.00; bulk	18.00
Buckingham, Que.—Color, white; analysis, K_2O, 12-13%; Na_2O, 1.75%; bulk	9.00
De Kalb Jct., N. Y.—Color, white; bulk (crude)	9.00
East Hartford, Conn.—Color, white, 95% through 60 mesh, bags	16.00
96% thru 150 mesh, bags	23.00
Erwin, Tenn.—Color, white; analysis, 12.07% K_2O, 19.34% Al_2O_3; Na_2O, 2.92%; SiO_2, 64.76%; Fe_2O_3, .36%; 98.50% thru 200 mesh, bags, 16.90; bulk	15.50
Glen Tay Station, Ont., color, red or punk; analysis: K_2O, 12.81%, crude (bulk)	6.75@ 7.50
Keystone, S. D.—Prime white, bulk (crude)	8.00
Los Angeles, Calif.—Color, white; analysis, K_2O, 10.35%; Na_2O, 3.62%; Al_2O_3, 18.71%; SiO_2, 65.48%; Fe_2O_3, .17%; 99% thru 200 mesh, bags included, carloads	22.00
Bulk	20.00
Murphsboro, Ill.—Color, snow white; analysis SiO_2, 64.4%; K_2O, 13%; Na_2O, 2.5%; Fe_2O_3, 0.07%; Al_2O_3, 19.3%; 98% thru 200 mesh, bags	21.00
Bulk	20.00
Penland, N. C.—Color, white; crude, bulk	8.00
Ground, bulk	16.50
Tenn. Mills—Color, white; analysis K_2O, 18%; Na_2O_3, 10%; 65% SiO_2; 99% thru 200 mesh; bulk	18.00
99% thru 140 mesh, bulk	16.00
Toughkenamon, Pa.—Color, white to light cream; 98% thru 150 mesh, bags, 11.00@13.00; bulk	10.00
Toronto, Can.—Color, flesh; analysis K_2O, 12.75%; Na_2O, 1.96%; crude	7.50@ 8.00
Trenton, N. J.—Crude, bulk	12.00@27.00
99% thru 140 mesh; bulk (Bags 11 cents each, non-returnable)	16.00
Wheeling, W. Va.—Color, white; analysis, K_2O, 9.50%; Al_2O_3, 16.70%; Na_2O, 3.50%; SiO_2, 69.50%; 99% thru 140 mesh, bulk	19.00

Blended Feldspar

(Pulverized)

Tenn. Mills—Bulk	16.00@20.00

Chicken Grits

Afton Mich. (limestone) per ton	10.00
Belfast and Rockland, Me.—(Limestone), bags, per ton	‡10.00
Brandon and Middlebury, Vt., per ton	12.00‡
Centerville, Iowa (gypsum) per ton	18.00
Chico, Texas (limestone), 100 lb. bags, per ton	8.00@ 9.00
Los Angeles Harbor (limestone), 100-lb. sack, 1.00; sacks, per ton, 8.50@ 9.50†; bulk, per ton	6.00@7.00†
Toughkenamon, Pa.—(Feldspar) 100-lb. bags, 1.00; bulk, per ton	10.00
Gypsum, Ohio.—(Gypsum) per ton	10.00
Limestone, Wash. (limestone) per ton	12.50
Rocky Point, Va. (limestone) 100 lb. bags, 75c; sacks, per ton, 6.00 bulk	5.00
Seattle, Wash.—(Limestone), bulk, per ton	12.50
Warren. N. H.—(Mica) per ton	7.80
Waukesha, Wis.—(Limestone), per ton	8.00
West Stockbridge, Mass.—(Limestone) bulk	7.50@9.00*

*L.C.L.
†Less than 5-ton lots.
‡C.L.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis.	10.50
Boston, Mass.	*17.00
Brighton, N. Y.	*19.75
Dayton, Ohio	12.50@13.50
Detroit, Mich.	‡17.50
Farmington, Conn.	17.00
Flint, Mich.	¶12.50@16.00
Grand Rapids, Mich.	12.00
Hartford, Conn.	*20.00
Jackson, Mich.	13.00
Lancaster, N. Y.	13.00
Madison, Wis.	†a14.00
Michigan City, Ind.	12.00
Milwaukee, Wis.	*13.00
Minneapolis and St. Paul, Minn.	11.25
New Brighton, Minn.	10.00
Pontiac, Mich.	11.00@12.00
Portage, Wis.	15.00
Rochester, N. Y.	19.75
Saginaw, Mich.	13.50
San Antonio, Texas	13.00
Sebewaing, Mich.	12.00
Syracuse, N. Y.	18.00
Toronto, Canada	13.00
Wilkinson, Fla.	10.00@12.00

*Delivered on job. †Delivered in city limits.
‡Less 5%. ¶Dealers' price. (a) Less 1.00 E.O. M. 10 days.

Portland Cement

Prices per bag and per bbl, without bags net in carload lots.

	Per Bag	Per Bbl.
Albuquerque, N. M.	.....	3.47
Atlanta, Ga.	.....	2.35
Baltimore, Md.	.....	1.70@2.35
Birmingham, Ala.	.....	2.30
Boston, Mass.	.....	1.81@2.63‡
Buffalo, N. Y.	.....	1.67@2.38‡
Butte, Mont.	.90¼	3.61
Cedar Rapids, Iowa	.....	2.34
Charleston, S. C.	.....	2.35
Cheyenne, Wyo.	.82¾	3.31
Cincinnati, Ohio	.....	2.37
Cleveland, Ohio	.....	2.29
Chicago, Ill.	.....	2.20‡
Columbus, Ohio	.....	2.34
Dallas, Texas	.....	2.10
Davenport, Iowa	.....	2.29
Dayton, Ohio	.....	2.38
Denver, Colo.	.66¼	2.65
Detroit, Mich.	.....	2.15‡
Duluth, Minn.	.....	2.09
Houston, Texas	.....	2.60
Indianapolis, Ind.	.....	2.29
Jackson, Miss.	.....	2.60
Jacksonville, Fla.	.....	2.35
Jersey City, N. J.	.....	1.85@2.33
Kansas City, Mo.	.....	2.02‡
Los Angeles, Calif.	.61†	2.44†
Louisville, Ky.	.....	2.27
Memphis, Tenn.	.....	2.60‡
Milwaukee, Wis.	.....	2.25
Minneapolis, Minn.	.....	2.32‡
Montreal, Que.	.....	1.90
New Orleans, La.	.....	2.20
New York, N. Y.	.....	1.77@2.25‡
Norfolk, Va.	.....	2.17
Oklahoma City, Okla.	.....	2.46‡
Omaha, Neb.	.....	2.36‡
Peoria, Ill.	.....	2.27
Philadelphia, Penn.	.....	1.85@2.41‡
Phoenix, Ariz.	.....	3.70
Pittsburgh, Penn.	.....	2.09
Portland, Colo.	.....	2.80
Portland, Ore.	.....	2.90
Reno, Nevada	.75¼	3.01
Richmond, Va.	.....	1.69@2.44
Salt Lake City, Utah	.70¼	2.81
San Francisco, Calif.	.....	2.31‡
Savannah, Ga.	.....	2.50
St. Louis, Mo.	.55	2.20‡
St. Paul, Minn.	.....	2.32
Seattle, Wash.	10c discount	2.65
Tampa, Fla.	.....	2.60
Toledo, Ohio	.....	2.20
Topeka, Kans.	.....	2.41‡
Tulsa, Okla.	.....	2.33‡
Wheeling, W. Va.	.....	2.17
Winston-Salem, N. C.	.....	2.78

NOTE—Add 40c per bbl. for bags.
†Delivered on job in any quantity, sacks extra.
‡Ten cents less to dealers.

Mill prices f.o.b. in carload lots, without bags, to contractors.

	Per Bag	Per Bbl.
Buffington, Ind.	.....	1.85
Chattanooga, Tenn.	.....	2.45*
Concrete, Wash.	.....	2.35
Davenport, Calif.	.....	2.05
Detroit, Mich.	.....	2.15
Hannibal, Mo.	.....	2.05
Hudson, N. Y.	.....	2.05
Leeds, Ala.	.....	1.95
Mildred, Kans.	.....	2.35
Nazareth, Penn.	.....	1.95
Northampton, Penn.	.....	1.95
Richard City, Tenn.	.....	2.05
Steelton, Minn.	.....	1.90
Toledo, Ohio	.....	2.20
Universal, Penn.	.....	1.85

*Including sacks at 10c each.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gauging Plaster	Wood Fiber	White Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	—Plaster Board— ¼x32x 36". Wt. 1500 lb. Per M Sq. Ft.	—Plaster Board— ⅜x32x 36". Wt. 1850 lb. Per M Sq. Ft.	Wallboard, ⅜x32 or 48". Lgths. 6'-10', 1850 lb. Per M Sq. Ft.
Arden, Nev. and Los Angeles, Calif.	3.00	8.00u	8.00u	10.70u	10.70u	.....	.....	.....	.....	11.70u	.....	.....	.....
Centerville, Iowa	3.00	10.00	15.00	10.00	10.00	10.50	13.50	.....	.....	13.50	.....	.....	.....
Detroit, Mich.‡	.....	.....	.....	11.30	11.30	11.30	.....	8.00	.....	.....	.....	.....	.....
Delawanna, N. J.	.....	.....	.....	.....	.....	8.00	..... 8.25@9.40		.....	.....	.14½s	.15½s	40.00@41.00
Douglas, Ariz.	.....	.....	7.00	.....	.....	15.50d	18.50	.....	30.00	15.50	.....	.....	.....
Grand Rapids, Mich.	2.75	6.00	6.00	8.00	9.00	9.00	17.50	.....	24.55	20.00	.....	.....	.....
Gypsum, Ohio‡	3.00	4.00	6.00	9.00	9.00	9.00	19.00	7.00	27.00	19.00	.....	15.00	30.00
Hanover, Mont.	.....	.....	.....	11.80	.....	.....	.....	.....	.....	.....	.....	.....	.....
Los Angeles, Calif.	.....	.....	10.40	10.40k	.....	.....	.....	.....	.....	.....	.....	.....	.....
Port Clinton, Ohio	3.00	4.00	6.00	10.00	9.00	9.00	21.00	7.00	30.15	20.00	.....	20.00	30.00
Portland, Colo.	.....	.....	.....	10.00	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Francisco, Calif.	.....	.....	.....	13.40r	14.40r	.....	15.40r	.....	.....	.....	.....	.....	.....
Seattle, Wash.	6.50	.....	11.00	16.00	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sigurd, Utah	.....	.....	.....	.....	.....	.....	.....	.....	21.50	.....	.....	.....	.....
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00	.....	.....	.....	.....	20.00	25.00	33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable).
*To 3.00; †to 11.00; ‖to 12.00; ‡prices per net ton, sacks extra; (a) to 25.00; (b) net; (c) gross; (d) hair fibre; (f) delivered; (h) delivered in six states; (i) delivered on job; (k) sacks 12c extra, rebated; (m) includes paper bags; (o) includes jute sacks; (r) including sacks at 15c; (s) per board; (t) to 16.50; (u) includes sacks; (v) F.O B. N. Y. C. and dealers yard in mill locality.

Market Prices of Cement Products

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point

City of shipping point	Sizes 8x8x16	8x10x16	8x12x16
Camden, N. J.	17.00		
Columbus, Ohio	.16@.18a		
Detroit, Mich.	19.00‡		28.00‡
Forest Park, Ill.	18.00*	23.00*	30.00*
Grand Rapids, Mich.	.15		
Graettinger, Iowa	.18@.20		
Indianapolis, Ind.	.14@.16†		
Los Angeles, Calif.¶	5¾x3½x12—55.00	7¾x3½x12—65.00	
Oak Park, Ill.	.18@.21a		
Olivia and Mankato, Minn.	9.50b		
Somerset, Pa.	.20@.22		
Yakima, Wash.	20.00*		

*Price per 100 at plant. †Rock or panel face. (a) Face. ‡Delivered. ¶Price per 1000. (b) Per ton.

Cement Roofing Tile

Prices are net per sq. in carload lots, f.o.b. nearest shipping point unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.

Red	15.00
Green	18.00
Chicago, Ill.—per sq.	20.00

Cicero, Ill.—Hawthorne roofing tile, per sq.

	Chocolate Red and Orange	Yellow, Tan Green and Blue	Slate Gray
French and Spanish†	$11.50	$13.50	$12.75
Ridges (each)	.25	.35	.30
Hips	.25	.35	.30
Hip starters	.50	.60	.60
Hip terminals, 2-way	1.25	1.50	1.50
Hip terminals, 4-way	4.00	5.00	5.00
Mansard terminals	2.50	3.00	3.00
Gable finials	1.25	1.50	1.50
Gable starters	.25	.35	.30
Gable finishers	.25	.35	.30
*End bands	.25	.35	.30
*Eave closers	.06	.08	.06
*Ridge closers	.05	.06	.05

*Used only with Spanish tile.
†Price per square.

Houston, Texas.—Roofing Tile, per sq.	
Red	17.00
Green	19.50
Indianapolis, Ind.—9"x15"	
Gray	10.00
Red	11.00
Green	13.00
Waco, Texas:	Per sq.
4x4	.60
4x8x12	65.00
Mt. Pleasant, N. Y.:	Per 1000
5x8x12	78.00
Grand Rapids, Mich.:	Per 1000
5x8x12	70.00
Houston, Texas:	
5x4x12 (Lightweight)	45.00
5x8x12 (Lightweight)	80.00
Pasadena, Calif.—(Stone Tile	Per 100
3½x4x12	3.00
3½x6x12	5.00
3½x8x12	6.00
Wildasin Spur, (Building Tile) Los Angeles, Calif.:	Each
4x3½x12	.03½
6x3½12	.04½
8x3½x12	.05½
Yakima, Wash.—Building tile:	
5x8x12	.10

Cement Building Tile

Cement City, Mich. — 5"x8"x12", per M	55.00
Detroit, Mich.—5x8x12, per 100	8.50
Longview, Wash.—(Stone Tile)	Per 1000
4x6x12	55.00

Cement Drain Tile

Graettinger, Iowa drain tile per 100 ft.	
5-in	4.50
6-in	5.60
8-in.	9.00
10-in.	12.00
12-in.	17.50
14-in.	25.00
16-in.	35.00
18-in.	45.00
20-in.	60.00
22-in.	70.00
24-in.	80.00
30-in.	100.00
Olivia and Mankato, Minn.—Cement drain tile, per ton	8.00
Tacoma, Wash.—Drain tile per ft.:	
3 in.	.04
4 in.	.05
6 in.	.07½
8 in.	.10
Waukesha, Wis.—Drain tile, per ton	9.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	20.00	30.00@35.00
Baltimore, Md. (Del. according to quantity)	15.50	22.00@50.00
Camden and Trenton, N. J.	17.00	
Ensley, Ala. ("Slagtex")	14.50	22.50@33.50
Eugene, Ore.	25.00	35.00@75.00
Friesland, Wis.	22.00	32.00
Longview, Wash.	20.00	
Milwaukee, Wis	15.00	30.00@50.00
Mt. Pleasant, N. Y.		14.00@23.00
Omaha, Neb.	18.00	30.00@40.00
Pasadena, Calif.	12.50	
Philadelphia, Penn.	15.00	20.00
Portland, Ore.	17.00	25.00@75.00
Prairie du Chien, Wis.	14.00	22.50
Rapid City, S. D.	18.00	25.00@40.00
Waco, Texas	16.50	32.50@125.00
Watertown, N. Y.	20.00	35.00
Wauwatosa, Wis.	14.00	20.00@42.00
Winnipeg, Man.	14.00	22.00
Yakima, Wash.	22.50	

†Gray. ‡Red.

Large Cement Products Plant to Be Built at Lorain, Ohio

A $75,000 CEMENT products plant, said to be the largest of its kind between Cleveland and Detroit, will be erected by the Lorain Crystal Ice Co. at Lorain, Ohio. Contract for the construction has already been let and the plant is expected to be completed within three months.

The plant, 112x74 ft., will be built on a site owned by the company and which also contains a sand deposit. Slag will be used for aggregate and will be obtained from the National Tube Co. The entire plant will be electrically operated. It is planned that the initial capacity will be about 3000 back-up tile, 10,000 brick and 2400 block per day. In addition, concrete porch piers, and ornamental art objects of cement will also be made.

William Seher is president of the Lorain Crystal Ice Co., John Dorn, Sandusky, vice-president; A. Kuebler, Sandusky, secretary, and E. A. Braun, treasurer. Paul Plato will be general manager of the cement products plant.—*Lorain (Ohio) Journal.*

Panels of Asbestos and Cement

THE Asbestos, Shingle, Slate and Sheathing Co., Ambler, Penn., is again enlarging its facilities for the manufacture of ebonized asbestos lumber, which is used as a material for switchboards, instrument panels and similar purposes where a polished material of high dielectric value is required. This is the second time within a year that it has been necessary to devote increased space and equipment to the manufacture of this material. The asbestos lumber is made from asbestos and portland cement, beaten together, built up in layers, consolidated under tremendous hydraulic pressure and finally treated to give it a black ebonized surface. It possesses great strength and is easily cut and drilled.

Highway Engineering Courses to Be Given at Ann Arbor

THE University of Michigan, Ann Arbor, Mich., will conduct special courses in highway engineering and transport from June 21 to August 13. The courses are open to all who are interested in highway problems and will be in charge of Prof. A. H. Blanchard.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted.

Culvert and Sewer	4 in.	6 in.	8 in.	10 in.	12 in.	15 in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Detroit, Mich.								$14.00 per ton									
Graettinger, Iowa	.04½d	.05½	.08½	.12½	.17½	.....	.40	.50	.60	.70	.....	.....	.....	.....	.....	.....	.....
G'd Rapids, Mich. (b)	.....	.....	.....	.60	.72	1.00	1.28	.....	.....	1.92	2.32	3.00	4.00	5.00	6.00	.....	.....
Houston, Texas	.....	.19	.24	.43	.55½	.90	1.30	.....	†1.70	2.20	.....	.....	.....	.....	.....	.....	.....
Indianapolis, Ind. (a)	.....	.....	.....	.80	.90	1.10	1.30	.....	.....	1.70	.....	2.70	.....	.....	.....	.....	.....
Longview, Wash.							Sewer pipe 40% off list, culvert—list										
Mankato, Minn. (b)	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.50	1.75	2.50	3.25	4.25	.....	.....	.....
Olivia & Mankato, Minn.												12.00 per ton					
Paullina, Iowa‡	.....	.....	.....	.....	.....	.....	.....	2.25	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Somerset, Pa.	.....	.....	.....	.....	80[1]	1.00[2]	1.40[3]	.....	.....	2.00[4]	.....	3.25[5]	4.00[6]	6.00[7]	.....	.....	.....
Tacoma, Wash.	.15	.18	.22½	.30	.40	.55	.80	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tiskilwa, Ill. (rein.) (a)	.....	.....	.....	.65	.75	.85	1.10	1.60	.....	1.90	.....	.....	3.40	.....	.....	.....	.....
Wahoo, Neb. (b)	.....	.....	.....	.....	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	4.62	6.14	6.96	7.78
Waukesha, Wis.								12 in. to 60 in. 18.00 per ton									
Yakima, Wash.								$10.00 per ton									

*30-in. lengths up to 27-in. diam., 48-in. lengths after; (a) 24-in. lengths; (b) Reinforced; (c) Interlocking bar reinforced.
†21-in. diam. ‡Price per 2 ft. length. (d) 5 in. diam. [1]@1.08. [2]@1.25. [3]@1.65. [4]@2.50. [5]@3.85. [6]@5.00. [7]@7.50.

Choice of Sand for Steel Castings*

Characteristics Requisite for Foundry Work

THOSE whose occupations do not take them frequently into the foundry have no adequate realization of the extent to which the production of castings of any metal depends upon sand. Nature seems to have provided sand banks largely for the benefit of the foundryman. The earlier castings were poured in molds made of sands locally available. As the founding of metals progressed, the selection of sands fairly well adapted to the castings produced marked a forward step in the industry. The disintegrated portions of rocks which we call sand are generally found associated with organic and inorganic matter having the physical property of imparting cohesiveness. Foundrymen who make iron castings and those of non-ferrous metals are fortunate in having available for their purposes, many sand supplies whose natural characteristics are such as to require no additions to give them the needed cohesiveness for foundry use. Most of the sands employed for making gray iron, malleable iron, brass, bronze, and aluminum castings naturally contain ingredients which impart the necessary plasticity for making sharp outlines, and give the rammed mass the required stability to hold its shape, prior to and during the pouring operation.

Naturally Bonded Sands

It so happens that the naturally bonded sands are, in the main, of a relatively low fusion point, under that of the temperature at which steel must be poured for the production of castings. This fact necessitates the utilization for steel molding of natural sand deposits in which generally there is almost an entire absence of bonding material. Exceptions are found in a few sands whose refractory value is reasonably high, and in which there is a considerable amount of natural clay that does not fuse at a relatively low temperature. Such sands are not available to the great majority of steel foundries, which must depend upon synthetic mixtures having as a base, sand which, when analyzed, ordinarily shows from 95 to 99 per cent of silica. Silica is the predominating substance found in the crust of the earth.

Grains of silica sand are fragments of quartz rock, which have been broken down through the agencies of earthquakes, volcanic eruptions, glacial movements, and other forces of nature, such as wind, rain, snow, etc. The rock that has been reduced by fragmentation to small particles characteristic of sand, in some cases has had its sharp and irregular edges rounded. In other instances, the sand grains have retained much of their original angularity.

There are deposits of silica sand which have been subjected to such geological conditions as to have been loosely cemented into masses requiring blasting and subsequent pulverizing to make them available for industrial use. Other sands require no such expensive treatment to make them commercially applicable.

All sand deposits contain a relatively large variety of sizes of grains. Some sand banks are characterized by a great proportion of relatively large grains, while other deposits are typified by a large percentage of very small fragments.

Careful Discrimination Required Among Many Available Varieties

No one who has not given considerable study to molding sands can appreciate their enormous variety, and the resulting need for careful discrimination by the foundryman. He naturally understands better than does any casting user the extent to which the production of a good casting depends upon the nature of the sand mold in which it is formed. Sand may be said to be the common mother of all castings. The extent to which this material provided by nature has been superseded by devices having more or less permanence of form, is small. There has been a great deal of ingenuity displayed in researches planned to develop what we term permanent molds. These have been found economical for certain kinds of castings required in large quantities. However, the most optimistic exploiters of permanent molds have no expectation of the adaptation of such molds to innumerable varieties of castings which must continue to be formed through the use of the material with which nature has fortunately been so lavish.

Artificial Binders for Molding Sand

In this country the creation of the steel foundry industry in 1867 necessitated the search for more refractory sands than had been utilized for making iron castings. This was because the temperature required for pouring iron castings is customarily much lower than that needed for giving the necessary fluidity to steel. Ordinarily the carbon content of iron castings is from 2½ to 3%. The percentage of carbon in steel used for castings is generally from .20 to .50%. Other things being equal, the fluidity of molten ferrous metal is reduced as the carbon content is lowered. This is the factor that necessitates a relatively higher refractory value of the sand for steel molding as compared with that for iron molding. It can be readily appreciated that there are many more sand deposits adaptable for making iron castings than there are for producing steel castings, since the great majority of banks contain impurities, the effect of which is to lower the fusion point.

In steel molding, as indicated before, it is common practice to use what is termed silica sand, and to add to it a relatively small proportion of pulverized fire clay so that the mass will have the desired plasticity and stability. The mixture is, therefore, synthetic. Dependence is not placed universally upon clay alone for bonding purposes. Some foundrymen introduce other dry binders. A few add liquid binders as a supplementary procedure.

Plasticity and Cohesiveness Are Different Properties

Plasticity and cohesiveness are sometimes considered incorrectly as the same characteristic. As a matter of fact, these are different properties, although related to each other. A material may have a high degree of plasticity, permitting it to be formed into shapes having sharp outlines, which however may not retain this condition long enough to justify classification in the category of materials having good bonding strength. On the other hand, there are substances of coarse texture containing ingredients permitting them to be rammed into compact, reasonably permanent forms that have poorly defined outlines, due to a low plasticity value.

Some foundrymen resort to the use of both clay and farinaceous binders for obtaining what is thought to be a desirable combination of bonding strength, plasticity, and "peeling" properties, the latter believed to be imparted by the farinaceous binders. These are fusible at a relatively low temperature, below that typical of the pouring operations in any kind of foundry. Gas is produced by the combustion of the farinaceous material, and is thought by some to form an envelope between the face of the casting and the inside surface of the mold, which serves to prevent the close adherence of the sand grains to the casting. If a facing does not peel satisfactorily, the cleaning operation is more difficult, and the appearance of the casting may be marred.

Many prefer not to use an amount of clay sufficient to give the required degree of cohesiveness to a synthetic mixture. The clay ordinarily sold for foundry use has a lower fusion point than has silica sand. The result is a less refractory condition of a molding mixture containing the regular grade of clay, as compared with an equivalent volume of typical silica sand. This is important in connection with the effect on clay. When its melting point is reached it will, if in immediate proximity to the casting, adhere tightly to it and to sand grains with which the clay particles are in contact. At a temperature considerably below the fusion point and ordinarily around 800 deg. F., the bonding strength of the clay is entirely and permanently lost. The employment of used sand that has had no special treatment to purify it, means the introduction into the molding mixture, of considerable finely divided material which once was clay, which no longer has a cohesive value, and which has a poor refractory value.

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New Machinery and Equipment

New One-Yard Shovel

THE Bucyrus Co., South Milwaukee, Wis., has recently announced a new steam shovel, the 31-B, of 1-yd. capacity and full revolving. The design is said to include the regular Bucyrus features such as the outside dipper handle, box girder boom, two-part hoist direct connected to dipper, unobstructed dipper opening, swing engine mounted in front and caterpillars with the continuous treads with no gaps between links.

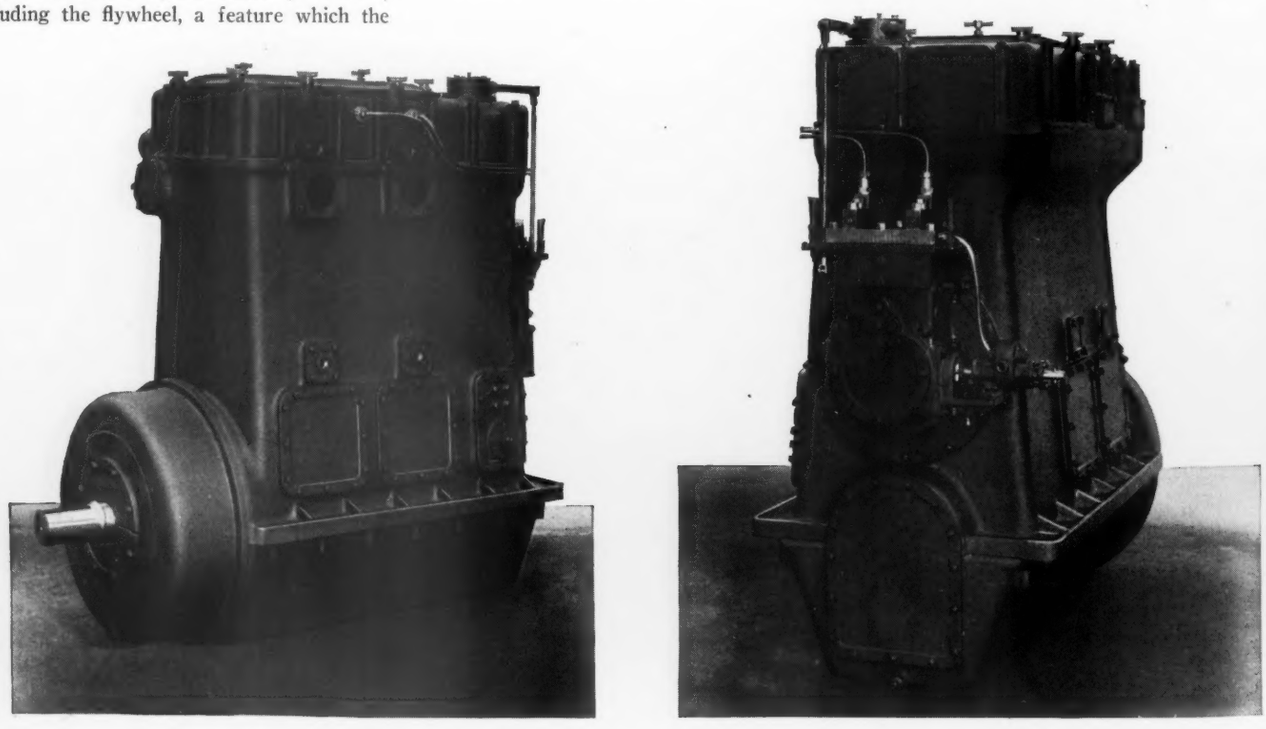
The standard machine, it is claimed, will cut a level floor 16 ft., 7 in., dig 4 ft. 11 in. below grade and dump 12 ft. 6 in. above the floor level. It is also available, it is said, as a high lift shovel, dumping 18 ft. above the floor and as an extra high lift with ⅞-yd. dipper that reaches its extreme dumping height of 21 ft. 7 in.

New 1-yd. steam shovel available for high lift

New Diesel Engine

A NEW Diesel engine said to contain new and distinctive features is announced by the Foos Gas Engine Co., Springfield, Ohio. The new engine called type "L" is said to be adaptable for installation in mobile or semi-mobile machinery requiring self-contained industrial power units. This applies to shovels, cranes, etc. In stationary applications it can be used as a peak load or standby power generator, dredge pump drive, etc.

The new Diesel engine is entirely enclosed, including the flywheel, a feature which the manufacturers say makes for more successful operation; for working parts as bearings, etc., are kept dust free and lubricating oil is confined absolutely, permitting no leakage.



Exhaust rear view (left) and control end (right) of new Diesel engine

Cover plates on the sides and top allow access to the engine parts. The engine is four-cycle and operates on the full Diesel combustion cycle. A central lubricating oil system furnishes oil to all bearings under pressure. There are no grease cups, oil cups, etc., on the unit. The dual valve system is provided in each head, two inlet and two exhaust. Valve operation is controlled by a cam shaft which is driven by a silent chain drive direct from the crank shaft.

The operating speed range of the new Diesel engine is given at from 400 to 900 r.p.m. The design of the sprays of the fuel system are said to permit the use of low gravity fuels. The weight per horsepower of the unit is said to be from 30 to 60 lb., dependent on the materials used and the speed, while the capacity ranges from 45 to 475 hp.

New Vibrating Screen

A NEW vibrating screen, electrically operated by reciprocating motors, is announced by the Traylor Vibrator Co., Denver, Colo. The "Screen Supreme," as it is called, is said to be a very compact unit and easy to install and economical in operation; requiring about ½ h.p., it is said, for the maximum load under ordinary conditions.

The manufacturers claim the following features for the new machine: Enclosed shock absorbers that eliminate vibration between the screen and super-structure or support, uniform vibration, no oiling or greasing necessary, and a light construction made possible through absence of moving parts or pulleys. The screen, it is said, handles light or heavy material, in dry or wet form, in an efficient manner.

All parts of the machine are said to be easily accessible and screen cloth and sashes may be changed in only a few minutes. It is designed to operate on 110, 220 or 440-volt, 60 cycle alternating current with an a.c. motor d.c. generator set of small capacity.

Motor Trolley for Small Hoists

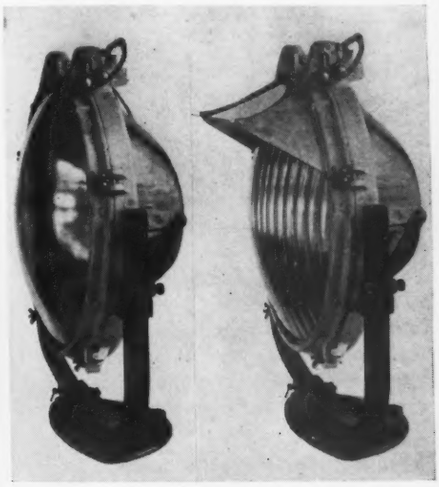
A NEW motor-driven trolley has been developed by the American Engineering Co., Philadelphia, Penn., for use with half-ton and one-ton electric hoists. The trolley can be supplied with travel speeds of 80 or 120 ft. a minute. Accurate control is said to make it efficient in spotting work for machine tool operations and it can also be arranged for remote control, if desired.

Only 22-in. headroom is said to be required for the hoist and trolley. Maximum traction is said to be obtained by driving all four wheels. The three main castings, from which hoist and load are suspended, are of cast steel. The spur gear drive is totally enclosed and runs in an oil bath. Hyatt roller bearings are used on all shafts. The motor also is totally enclosed and has ball bearings and can be furnished for d.c. or a.c., either 2- or 3-phase.

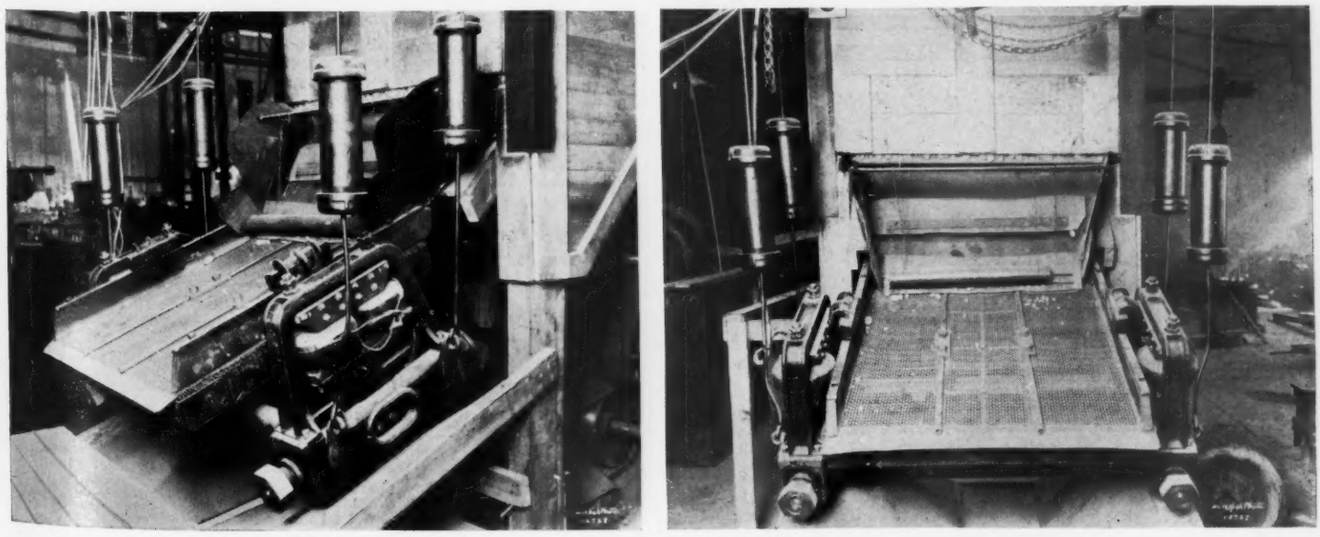
Motor trolley for small hoists

New Floodlight Projector

THE Pyle-National Co., Chicago, Ill., has recently added type No. 2375 projector to their line of floodlight and headlight products. The case of the projector is of aluminum alloy with an absolutely tight closure which is said to eliminate depreciation of reflective value by entirely excluding dust, gases, moisture, etc., from the interior. Ventilation is said to be unnecessary in this design, for the radiating surfaces are said to insure safe interior temperatures for the glass reflector and lamp when using 1000 and 1500 watt lamps. Crystal glass reflectors 23 in. in diameter are used and these as well as rectangular divergence lenses are optional on this unit. The projector may be equipped with a visor if desired. The use of such lights is becoming more common each year in the rock products industries. Stone quarries use them for night loading and sand and gravel dredges both for excavating work and for loading and unloading barges.



Flood light projectors for night quarry working



New vibrating screen with electrical vibrators and pneumatic shock absorbers

Causes of Concrete Disintegration

An Editorial in "The Contract Journal" (London, England) on American Practice

IT would seem that either concrete construction work is not carried out in some countries on the same scientific lines as it is here, or that inferior materials are more generally employed, as a certain amount of disquiet is evident abroad in connection with the disintegration of concrete. In fact, the professor of chemical engineering at the University of Michigan said, a few days ago, that nearly everyone in Canada who keeps his eyes open is familiar with instances where such disintegration has occurred or is occurring.

We do not believe that such a remark could have been made at any period of the cement age in this country, and however true it may be of Canada, it certainly could not be made regarding concrete work in Great Britain. Of course, there are cases of failure, but they are few and far between, and can be traced in every case to poor workmanship, the use of inferior materials or ignorance of the fundamental properties of portland and other cements. Mr. A. H. White said, recently, that cement has many valuable properties and is one of our most important structural materials, but has latent possibilities of harm which no other major building material possesses. He added: "It's faults are, so far as we know, necessarily inherent in the material, and the only safety lies in recognizing its weaknesses and using it under proper conditions."

He justifies his remarks by saying that the property of portland cement which is of the greatest importance to the user is permanence, and in the course of a paper presented at a conference on highway engineering goes rather closely into that subject. He makes it clear at once that portland cement is a complex, semi-fused mixture whose chief constituents are known as the silicates and aluminates of lime. There is some doubt about the exact form of combination of the elements, and there is more doubt about the details of the processes which are involved when cement reacts with water. The old ideas of definite chemical combination are still firm in the minds of most engineers and many chemists, and the most prevalent conception of the mechanism of hardening is probably that portland cement reacts with water to form definite crystalline compounds which interlock and impart strength to the product. We know this is at least a half-truth, for the microscope shows the formation of crystals in the initial steps of the hardening process. The microscope also shows, however, the formation of cloudy materials which fill the field so that further changes in the hardening process are obscured. If an observer at a microscope could have ideal conditions and follow the behavior of cement from the time of its initial contact with water he would observe a rather voluminous white coat forming on each grain of cement. Some crystals would form and reach out to join or interlock with other crystals. Most of the products would, however, be pasty, or, as the chemist says, colloidal rather than crystalline. After a few hours the paste would have stiffened sufficiently to cause the cement to set. This paste of colloid would continue to get stiffer as the water ate deeper into each cement grain, forcing the decomposition products to pack more closely together. The action should logically continue until one of two things happens, either the cement becomes all decomposed by the water, or the reaction products become packed so tightly that no more water can force its way to the unchanged centers of the cement grains. If the cement becomes dry before either of these results happen, the process remains incomplete.

From this it will be seen that the percentage of water content in the mix is a matter of considerable importance, and one is reminded that some investigators have tried to study the hardening process of portland cement by observing the behavior of a small amount of cement suspended in a large amount of water. This condition is exactly the reverse of that which obtains in practice and does not lead to results which can be interpreted in the light of actual conditions. In any ordinary concrete it is the cement which is in excess and not the water. It is rare to have sufficient water present to combine with all the cement. Yet it is somewhat rash to say this, for the question arises at once as to how much water is actually combined with the cement in any given sample of concrete. The only truthful reply we can give to this, according to our authority, is that we do not know and cannot find out.

This seems like a surprising admission in this day and age, but it arises from our fundamental ignorance of what constitutes chemical combination. Where does moisture stop and chemically combined water commence? This is a question which it seems impossible to answer. As Mr. White says, one form merges into the other, and in the light of our present knowledge it is probably safer to consider all water which is not present as actual drops of liquid as being in some form of combination and exerting an influence on the properties of the concrete.

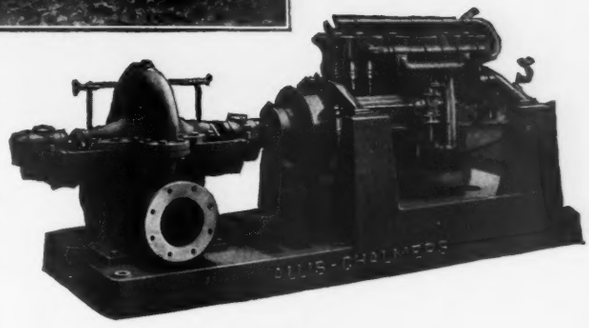
It is interesting to note that amongst the conclusions arrived at, after a lengthy and exhaustive series of tests, is this: That while frost is an important secondary cause of the disintegration of concrete, it has been shown that concrete, when properly made and hardened, contains practically no liquid water and that the colloid water does not expand on freezing. Sound concrete is therefore not harmed by freezing even when soaked with water. As soon, however, as even a hair crack appears in concrete, a gap is formed which permits liquid water to enter and freeze. The pressure of the ice formed increases the width and depth of the crack and through this ever-widening door disintegration proceeds at an accelerating pace.

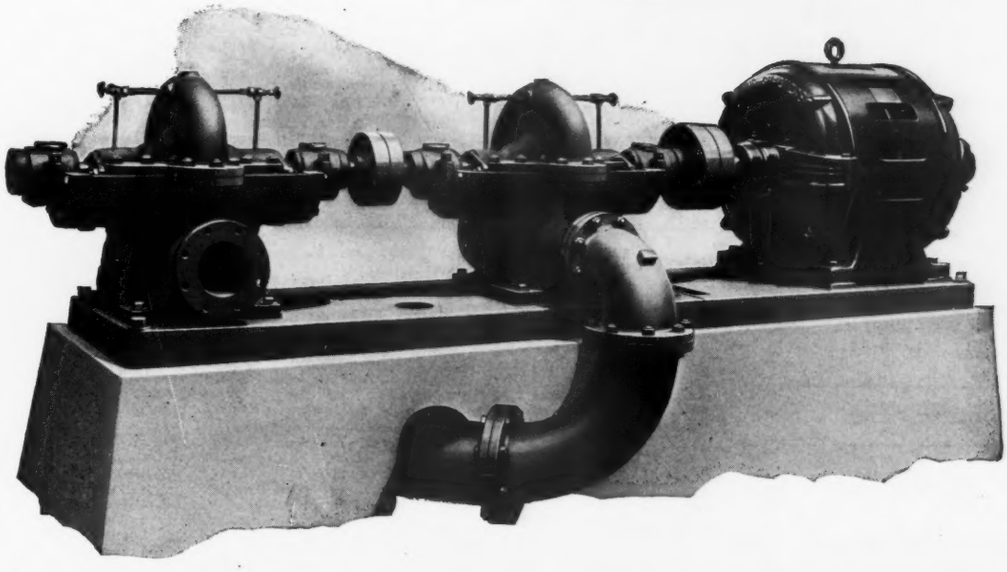
Even hair cracks must be prevented if disintegration is to be avoided when concrete is exposed in the open air in conditions where ice may form. Another secondary cause of disintegration of reinforced concrete is corrosion of the steel embedded in the concrete. Unbroken concrete of good quality protects steel excellently, but cracked concrete does not protect the steel at all. The expansive power of the rusting steel may burst the concrete. Corrosion of the steel caused the extensive visible damage, but the primary cause was a shrinkage crack which permitted water to reach the steel. Broadly speaking, the conclusion arrived at is that water is the cause of both the life and death of concrete. Reaction of the cement with water gives its strength. Continued contact with good water maintains its strength unimpaired for generations. Removal of the water of combination causes it to shrink and crack. Restoration of the water causes it to swell sometimes to more than its largest previous dimensions. Alternate expansion and contraction due to changes in moisture is the greatest underlying cause of the destruction of concrete structures, for the strains due to the volume changes produced by variations in the water content are usually far greater than those due to changes of temperature. Frost is harmless unless the concrete contains liquid water. Liquid water expands on freezing, combined water does not, and therefore concrete when properly mixed and hardened does not contain liquid water even though it is immersed in water, for the water which enters the pores of dry concrete becomes combined with the colloid of the cement.

[The above is printed not because the editors agree with it, but because it expresses views that are foreign in other than the geographical sense. It is surprising to find it stated that "in ordinary concrete, it is the cement which is in excess and not the water." The reverse is true in America.—Ed.]

Centrifugal Pumping Units
for
The Rock Products Industry

Six Allis-Chalmers 10-in. pumps with 200 H. P. motors are successfully and economically building sand dams for the Northern New York Utilities Company; two Allis-Chalmers gasoline engine driven pumps are building an earth fill dam at Asheville, N. C., by pump sluicing. Other Allis-Chalmers pumping units are removing overburden from gravel; still others are elevating, washing and conveying gravel. Our complete line of pumps with most any kind of drive required allows us to furnish the suitable pumping unit for most any requirement in the rock products industries. Write for Bulletin 1632-G.





ALLIS-CHALMERS
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News of All the Industry

Incorporations

Maine Gypsum Co., Calais, Me., 500 shares of no par common stock. B. Y. Curran, James Gray and G. A. Curran. To mine, quarry and manufacture gypsum and gypsum products.

Schoharie Stone Corp., Schoharie, N. Y. 500 shares of no par comon stock. C. and W. P. Mix, H. E. Blodgett. (Attys., Blodgett & Smith, Schenectady, N. Y.)

Thermo Tile Co., Pensacola, Fla. W. T. Porter, J. H. Irving and others. Has acquired the Murphy-Morrison Co. mill site at Brent and will install machinery to manufacture tile.

Buffalo Rock Silica Co., Chicago, Ill., decreased capital stock from $400,000 to $100,000 and changed par value of shares.

Blue River Sand and Gravel Co., Irving, Kan., $20,000. F. C. Burket, L. J. Stoll, C. N. Burket and F. A. Train.

Golden Sand and Gravel Co., Johnson City, Tenn., $100,000. G. T. Wofford, S. R. and G. C. Sells, J. R. Simonds and others.

Bedford-Carthage Stone Corp., Houston, Tex., $30,000. D. E. Braucht, R. M. Amrine and Jesse Box.

Valley Rock Products Co., Los Angeles, Cal., $10,000. A. F. Bridge and S. A. Thompson of Los Angeles and R. M. Ranyard of Santa Monica.

Logan Brick and Sand Co., Logan, W. Va., $20,000. C. R. Broom, J. F. May, G. F. Gore and others.

Arkhola Sand and Gravel Co., Fort Smith, Ark., $100,000. R. B. Hudson, John Northum and E. M. Douthit.

Ayar Stone Corp., Arcadia, Fla., $100,000. R. T. Bell, L. E. Engle and others. To manufacture synthetic stone.

Mogadore Sand and Gravel Co., Canton, Ohio., 5,000 shares of no par value. C. A. Calhoun, J. W. Coats, Walter McConnell and others.

Duntile & Builders Supplies, Ltd., Hamilton, Ont., $60,000. W. Carter, W. R. Carter, R. Reid.

St. Mary's Crushed Stone, Ltd., Toronto, Ont., $50,000. James and Leonard Francischini.

Select Cut Stone Co., Ltd., Windsor, Ont., $60,000. R. P. Lackner and others.

Ornamental Concrete Co., Omaha, Neb., $5,000. G. S. Johnson and W. W. Wenstrand.

Harriman Block & Tile Co., Harriman, Tenn., $10,000. T. A. Christmas and R. K. Hill.

Springfield Concrete Products Co., Springfield, Mo. C. D. Cope, 1427 E. Madison St., and others.

Porterville Granite Corp., San Francisco, Cal., $50,000. A. Bocci, F. Bocci and Wm. Klein.

Mammoth Cave Rock Asphalt Co., Wilmington, Del., $1,500,000. (Corp. Service Co.)

Maryland Concrete Block Co., Baltimore, Md., $30,000. Davis Bernstein and others.

Baltimore Concrete Double Wall Co., Baltimore, Md. Howard C. Wilcox and others.

Silica Co. of California, Inc., Wilmington, Del. $250,000.

Cumberland Portland Cement Co., Wilmington, Del., $4,000,000.

Smallwood Stone Co., Wilmington, Del., $7,500,000. (Corp. Trust Co. of America.)

Sand and Gravel

Coogan & Clark, Peoria, Ill., have leased the old Rock Island gravel pit near Chillicothe, Ohio. The pit was abandoned several years ago because of the amount of clay in the gravel, but the new operators expect to remove this difficulty by a more modern washing method. Both Mr. Coogan and Mr. Clark are veterans in the gravel industry and were formerly employees of the McGrath Sand and Gravel Co.

Calmo Mining and Milling Co., Angels Camp, Calif., have plans under way for the development of their gravel property at that place. The flume will be extended for washing the gravel and a centrifugal pump will be installed at the foot of the hill to pump water to the reservoir.

Kirkland Sand and Gravel Co., Kirkland, Wash., has been adding some new machinery to its plant.

McGeorge Gravel Co., Marshfield, Ore., suffered a loss of $2,000 by the demolishing of its dock and the loss of material in the bay. There was no insurance.

Engineering and Metals Mining Co. will begin black sand mining near Wedderburn, Ore., about July 1.

Public Service Sand and Gravel Co. is the name under which Wm. Hebner has engaged in business at 1008 Aviation drive, Los Angeles, Calif.

T. E. Harwood, Lacon, Ill., has purchased the half interest formerly held by James Moreland in the sand and gravel firm of Harwood & Moreland and will continue the business alone under the name of the South Lacon Gravel Co.

Midland Gravel Co. had a breakdown at their Millbrook, Mich., plant when the flywheel on the steam engine burst and wrecked part of the engine room. The accident was caused by the speed governor becoming stuck, which allowed the engine to "run away" at such a speed that the flywheel gave way under the strain. The loss was estimated at about $3,000.

A. R. Anderson & Co., Galesburg, Ill., are erecting a new sand and gravel plant at that place.

Quarries

Louis Tenara, Philadelphia, Penn., has purchased the quarry properties of E. P. Detweiler located at Edison, Penn., and will install modern crushing equipment and other machinery for the production of crushed stone.

William Penn Stone Co., the Sandstone Quarries Co., the Duluth Cut Stone Co. and the Port Wing Brownstone Co. have moved their office in Minneapolis from 510 Plymouth Bldg. to 408 Baker Bldg., on the corner of Second Avenue South and Seventh Street.

Western Granite and Marble Co. of San Jose, Calif. will establish a branch office and yard at Hollister, with M. Kelley in charge.

Cement

Alabama Portland Cement Co. has recently opened an office in Jacksonville, Fla., at 710 Bisbee Bldg., in charge of F. H. Brady. The Atlanta office is in charge of Ben Wallis.

Louisiana Portland Cement Co.'s plant at New Orleans, La., is progressing rapidly in construction. The machine shop building, office and other minor structures have already been completed.

Federal Portland Cement Co., Buffalo, N. Y., has ordered revised plans for its new cement plant to be built at Lackawanna, N. Y. The new plant includes, one, two and four story buildings and is to cost about $1,500,000 with equipment. J. G. Harding is to be general manager.

Cement Products

Logan Brick and Sand Co., Logan, W. Va., recently incorporated, is reported to have plans under way for the erection of a new plant for the manufacture of waterproof concrete blocks and brick. The initial output is expected to be from 10,000 to 12,000 brick per day.

Wilson Brick Co. have reopened their plant at Mount Dennis, Canada, for the manufacture of cement blocks.

Canadian Cincrete, Ltd., has acquired the Canadian rights to manufacture "cincrete" units under the "Bo-process." These cincrete blocks are now being made by the Toronto Brick Co., Ltd., Torono. Tests recently were made on the blocks at the University of Toronto in which it is said they stood 2,017 lb. per square inch.

A. B. Krempp & Sons, Jasper, Ind., have just completed the installation of a power tamper for making concrete blocks at their plant in Jasper.

Lime

Black Marble and Lime Co. is about to construct kilns, hydrating plant and aerial tramway at Enterprise, Ore.

Miscellaneous Rock Products

Canadian Pozzolana Co., Ltd. are now in full operation at their plant at Leaside, Ont. The officers are: G. H. Guinlock, president; J. D. Easton, managing director.

W. D. Haden Co., Bankers Mortgage Bldg., Houston, Tex., will soon begin the construction of a $50 000 plant to make grit for poultry feed. Will have a daily capacity of 150 tons.

Personals

Roscoe Seybold, formerly manager of price statistics of the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., has been appointed assistant to F. A. Merrick, vice-president and general manager of the company.

C. H. Connell, advertising manager of the Weller Mfg. Co., Chicago, has taken charge of the advertising of the Webster Mfg. Co.

Major Robert B. Jennings has been appointed general manager of the Robert W. Hunt & Co., Ltd., Canada, industrial and chemical engineers. He will make his headquarters at Montreal. Major Jennings received his education at various Canadian colleges and has been engaged in railway engineering and construction work in different capacities for the Canadian National Railways since 1909 to the present date, except for the time he served overseas as an officer in the Canadian army during the World War. He is a member of the Engineering Institute of Canada and the American Railway Engineering Association.

Manufacturers

The Northern Blower Co., Cleveland, Ohio, have begun the erection of a two-story addition to their plant, 120 ft. by 100 ft., to be used as machine, woodworking and sheet metal departments.

Timken Roller Bearings Co., Canton, Ohio, announce the following changes in management and personnel: H. E. Gilmore is now manager of the St. Louis branch of the Timken Roller Bearing Service and Sales Co.; G. W. Curtis, from industrial equipment engineer to district manager of sales, Milwaukee territory. Mr. Curtis will work with R. W. Ballentine, who previously has handled this territory. S. M. Weckstein succeeds Mr. Curtis as industrial equipment engineer. G. W. Richards and A. R. Spicacci are appointed assistant industrial equipment engineers to assist Mr. Weckstein. The Omaha branch is now located at larger quarters at 2240 Douglas St. and the management will continue under the direction of A. D. Hackim. The Los Angeles branch will be at 1361 S. Figueroa St.

Carr Fastener Co., Cambridge, Mass., manufacturers of "Dot" lubricating systems, announce that they have disposed of their interest in the automobile and commercial car field in order that they may devote their efforts to the development of the industrial field entirely. It is probable that the "Dot" lubricator will be surrounded with other industrial lubricator equipment so that its manufacturers may offer its industrial trade a more complete lubricator service.

Milwaukee Electric Crane and Mfg. Corp., Milwaukee, Wis., announces the appointment of W. C. Lloyd, 913 Empire Bldg., Pittsburgh, Penn., as their representative in the Pittsburgh district.

Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., announces the appointment of Francis Hodgkinson to the position of consulting mechanical engineer for the entire organization and A. D. Hunt to the position of manager of engineering, a new position recently created. Mr. Hodgkinson has been for many years chief engineer of the South Philadelphia works of the company and was recently awarded the Elliot Cresson gold medal by the Franklin Institute in recognition of his scientific achievements. Mr. Hunt has been a member of the engineering staff of the company for many years.

G. M. Basford Co., New York, have prepared an interesting personalized folder on refractories for their client, the Botfield Refractories Co. This has been circularized throughout the entire cement industry in the United States and Canada.

Gilman Manufacturing Co., East Boston, Mass., has appointed J. R. Elmendorf, western district manager and K. O. Duncan, San Francisco branch manager. Headquarters will be at the new office recently opened at 58 Sutter St., San Francisco.

Sullivan Machinery Co., Chicago, Ill., have moved their Northwestern sales office to new and larger quarters at 120 S. Lincoln St., Spokane, Wash. The display room and warehouse will be together at the new location and Robert T. Banks will be manager.

These firms have learned the value of centralized control

- Woodville Lime Products Co.
- Ohio Hydrate & Supply Co.
- Bruns Hydrated Lime Co.
- National Mortar & Supply Co.
- Kelley Island Lime & Transport Co.
- Luckey Lime & Supply Co.
- Limestone Products Co.
- G. & W. H. Corson
- Chazy Marble Lime Co.
- John Herzog & Son

THE concerns listed at the left have come to know the full meaning of the phrase applied to the Arnold & Weigel Lime Plant Service,

"Centralized Control"

They know what may be accomplished where all responsibility, from contracting and engineering to the installation of equipment, is centered in One Complete Service.

As a matter of fact, most of them knew it long ago, for most of these contracts are repeat orders now under construction.

That's significant.

ARNOLD & WEIGEL
WOODVILLE, OHIO, U.S.A.

When writing advertisers, please mention ROCK PRODUCTS

Manitowoc Engineering Works, Manitowoc, Wis., are building for installation by the California Portland Cement Co., Colton, Calif., a new cement kiln, 203 ft. x 11 ft. 6 in.

Cecil R. Lambert Co., Inc., Detroit, Mich., manufacturers of conveying and handling equipment, have changed their name to **Mechanical Handling Systems, Inc.** The company is making additions to plant and personnel, but there is no change in the ownership or management.

S. G. Taylor Chain Co., Chicago, Ill., have moved their offices from room 640 to 502 Marquette Bldg.

The Osgood Co., Marion, Ohio, has purchased from the receiver of the Fairbanks Steam Shovel Co., at Marion, Ohio, the good will and all the assets of the Fairbanks Steam Shovel Co., such as patterns, records, drawings, formers, etc., together with the entire stock of material that was on hand for the manufacture of steam and gas shovels and dredges. The purchasers are prepared to furnish from the records and drawings now in their possession repair parts for Fairbanks machinery and equipment that is now in the field. Charles Melvin, who was connected with the Fairbanks Steam Shovel Co. for twenty-four years, has been retained by the Osgood company and placed in charge of the department for handling service and repair parts on Fairbanks machines.

Trade Literature

NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention ROCK PRODUCTS.

Gear Problems. Catalog No. 200, containing much useful information on speed reducers, conveying equipment, gears, etc. Illustrated throughout and includes interesting and useful data on engineering and helpful mathematical tables for quick computation. Indexed. 622 pp., 5¼ x 7¾ in. FOOTE BROS. GEAR AND MACHINE CO., Chicago, Ill.

Flory Hoists... Bulletin S.L., describing and illustrating two-speed, hand-friction electric, gasoline and steam hoists specially designed for operating slack line excavator plants. Specifications, details, etc. S. FLORY MFG. CO., Bangor, Penn.

Mining Machinery and Supplies. New catalog on mining machinery, equipment, supplies, etc. Sections and listings on all equipment, etc. Useful and informative engineering data. Illustrated. 630 pp. MINE SMELTER AND SUPPLY CO., Denver, Colo.

Cableways for Coal Storage and Reclaiming. Pamphlet covering facts as to the value of the cableway on coal storage work. Contains much interesting data on operation costs, capacity, etc., and diagrams illustrating layouts at several plants. LIDGERWOOD MFG. CO., New York, N. Y.

Lime Rates to Central Territory Ordered Revised

THE revision of rates on lime ordered to be made not later than August 20, in No. 16170, Eastern Lime Manufacturers Traffic Bureau et al. vs. Akron & Barberton Belt et al., opinion No. 11233, 112 I. C. C. 7-28 (Traffic World, May 29), with which was joined a sub-number, Washington Building Lime Co. vs. Same, was treated by the Interstate Commerce Commission as one of the outgrowths of a complaint, filed early in 1922, by lime producers at Mitchell, Ind., in which it was alleged the rates from that point to central territory destinations in Pennsylvania, West Virginia, Ohio and Michigan were unreasonable and unduly prejudicial, in favor of manufacturers at Buckeystown, Frederick, Grove, and Lime Kiln, Md., Bakerton and Engle, W. Va., Stephens City and Strasburg, Va., and York, Pa.

Eastern complainants, it said, many of whom were complainants in the instant cases, did not participate in that case. In the report, by division 1, in Lehigh Lime Co. vs. Akron, Canton & Youngstown, 85 I. C. C. 341, called the Mitchell case, the Commission found the rates assailed unreasonable, unduly prejudicial to the Mitchell complainant and unduly preferential of the eastern points. A distance scale was prescribed. The carriers were directed to remove the undue prejudice by establishing rates from the eastern points that would bear the same relationship to the rates from Mitchell as that which would obtain on the basis of the distance scale from Mitchell, on the one hand, and of certain specified rates from the eastern points, on the other. The defendants complied but they extended the area of the application of the rates. Lime from Eastern Trunk Line Points, 93 I. C. C. 617, a suspension case, resulted. Division 3 found the proposed rates not justified.

Complainants, the commission said, were not in full accord as to the relief desired. Some subscribed to the views of the complaining traffic bureau and Lime Industries of Virginia. The commission referred to them as the bureau and used the names of complainants holding divergent views.

In the course of its report the commission reviewed the two decisions on lime hereinbefore mentioned and several cement cases and then made the following findings:

Upon all the facts of record we find that the interstate rates on common lime, hydrated, quick, or slaked, except agricultural and fluxing lime having no commercial value for building or chemical purposes, in carloads, minimum weight 30,000 lb., from points in Groups 1, 2, and 3, as hereinabove described, and from points in other groups named below to destinations in the 60 and 67% groups for the future will be unreasonable to the extent that they may exceed the following:

Group 1 13.5—15, Group 2 14.5—16, Group 3 15.5—17, Bloomsburg group 16—17.5, Bainbridge group 16—17.5, Riverton group 16.5—18, Scranton group 17—18.5, Cedar Hollow group 17.5—19, Trexlertown group 17.5—19. The former figures are to Pittsburgh and points in the Pittsburgh district; latter figures are to Youngstown, Sharon, Steubenville, Wheeling, and Erie—cents.

Rates to other destinations in the 60 and 67% groups should be revised to correspond with the rates prescribed to the destinations specified above.

We further find that rates on common lime, hydrated, quick, or slaked, except agricultural and fluxing lime having no commercial value for building or chemical purposes, in carloads, minimum weight 30,000 lb., to destinations in central territory other than the 60 and 67% groups, for the future will be unreasonable to the extent that they may exceed 26 cents to points in the 100% group, and to points in other groups rates arrived at by applying the established percentage for each of such groups to the 26-cent rate; that the rates from the Riverton group to destinations in central territory, other than those in the 60 and 67% groups, for the future will be unreasonable to the extent that they may exceed the rates herein prescribed from Groups 1, 2, and 3 by more than 1 cent; and that the rates from other groups in eastern territory to the same destinations, for the future will be unreasonable to the extent that they may exceed the rates herein prescribed from Groups 1, 2, and 3 by amounts greater than the present differentials.

We further find that the interstate rates on common lime, hydrated, quick, or slaked, except agricultural and fluxing lime having no commercial value for building or chemical purposes, in carloads, minimum weight 30,000 lb., from producing points in Ohio to destinations in central territory for the future will be unreasonable to the extent that they may exceed rates which would result from application of the scale set forth in Appendix B. In applying that scale existing groups of producing points, including the Sandusky, Carey, and Woodville groups, should be continued and distances computed in the manner specified in Atlas Portland Cement Co. vs. C. B. & Q. R. R. Co., 81 I. C. C. 1, as modified by the supplemental order of August 22, 1923, in that proceeding.

We further find that the interstate rates on agricultural and fluxing lime having no commercial value for building or chemical purposes, in carloads, from and to the points of origin and destination referred to in the foregoing findings for the future will be unreasonable to the extent that they may exceed 80% of the rates on common lime, hydrated, quick, or slaked, except agricultural and fluxing lime having no commercial value for building or chemical purposes, therein prescribed.

Insofar as the foregoing findings change the relationship between eastern producing points and Mitchell, prescribed in the Mitchell case and Suspension case, our findings in the latter cases are modified. We pointed out in those cases that there was no ground for a finding of undue prejudice to producers at Mitchell with respect to rates on agricultural and fluxing lime having no commercial value for chemical or building purposes, such as that manufactured at the eastern producing points. Our finding herein that such rates should not exceed 80% of the rates on higher grades is strictly a finding as to maximum reasonable rates and should not be construed as compelling increases in present rates on low-grade lime if it is desired to continue the latter rates because of carrier or market competition.

Appendix B, referred to in the findings, is as follows:

SCALE APPLICABLE FOR SPECIFIED DISTANCES

Distance	Rate. Cents
40 miles and over 25	9.5
55 miles and over 40	10
70 miles and over 55	10.5
85 miles and over 70	11
100 miles and over 85	11.5
120 miles and over 100	12
140 miles and over 120	12.5
160 miles and over 140	13
180 miles and over 160	13.5
200 miles and over 180	14
220 miles and over 200	14.5
240 miles and over 220	15
260 miles and over 240	15.5
280 miles and over 260	16
310 miles and over 280	16.5
340 miles and over 310	17
370 miles and over 340	17.5
400 miles and over 370	18
430 miles and over 400	18.5
460 miles and over 430	19
490 miles and over 460	19.5
530 miles and over 490	20
550 miles and over 520	20.5
580 miles and over 550	21
610 miles and over 580	21.5
640 miles and over 610	22
670 miles and over 640	22.5
700 miles and over 670	23

—*Traffic World.*